History of Botanical Researches in India, Burma and Ceylon

(31)

PART I. MYCOLOGY AND PLANT PATHOLOGY

By

S. N. DAS GUPTA, D.Sc. (Lond.)

Professor of Botany, Lucknow University
LUCKNOW, U.P.

Suppl. VI

BANGALORE CITY
PRINTED AT THE BANGALORE PRESS
1958

Price : Rs. 5.00 (*Postage Extra*)

History of
Botanical Researches in India, Burma and Ceylon

PART I. MYCOLOGY AND PLANT PATHOLOGY

By

S. N. DAS GUPTA, D.Sc. (Lond.)

Professor of Botany, Lucknow University

LUCKNOW, U.P.

BANGALORE CITY

PRINTED AT THE BANGALORE PRESS, MYSORE ROAD

1958

Price : Rs. 5.00 *(Postage Extra)*

CONTENTS

PREFACE

It was about five years ago that some Members of the Indian Botanical Society discussed with the UNESCO Science Co-operation Office for South Asia the possibility of producing a review of the botanical researches carried out in India, Burma and Ceylon during the last hundred years. UNESCO encouraged the project and promised to help us financially in the publication of the report and indeed gave a generous grant of six hundred dollars.

The matter was placed before the Annual General Meeting of the Indian Botanical Society held in January 1953 and the Secretary was requested to work out the details in consultation with the Members of the Executive Council. In the summer of 1953 some definite assignments were made for the preparation of the reviews. Later, these were slightly modified and the present list is as follows:—

1. *History of the Indian Botanical Society*—M. O. P. Iyengar.
2. *Algæ*—M. O. P. Iyengar and T. V. Desikachary.
3. *Mycology and Plant Pathology*—S. N. Das Gupta.
4. *Bryophytes*—S. K. Pandé.
5. *Pteridophytes*—N. P. Chowdhury.
6. *Gymnosperms*—P. Maheshwari and B. M. Johri.
7. *Systematic Botany of Angiosperms*—H. Santapau.
8. *Anatomy of Angiosperms*—G. C. Mitra.
9. *Floral Anatomy*—V. Puri.
10. *Wood Anatomy*—K. A. Chowdhury.
11. *Embryology of Angiosperms*—P. Maheshwari and B. M. Johri.
12. *Palæobotany*—A. R. Rao.
13. *Physiology*—K. N. Lal.
14. *Ecology*—R. Misra.
15. *Cytogenetics*—P. N. Bhaduri and S. Ramanujam.

In the preparation of these reviews it was decided to keep the following objectives in mind: (1) The information should be of real value to scientists. (2) The bibliography should be as complete as possible.

At the Baroda Meeting of the Indian Botanical Society held in January 1954, it was decided to turn over the work of editing the

manuscripts to me. Later at my request the Society agreed to form an Editorial Board consisting of four persons: Prof. P. Maheshwari, Prof. T. S. Sadasivan, Prof. A. Abraham and Dr. B. M. Johri.

Further as a result of discussions between the Members of the Editorial Board and Members of the Executive Council, it was finally decided to give up the idea of bringing out one single volume as this would involve a lot of delay. It seemed more appropriate that the reviews of the various branches of botany be published separately as and when ready. Accordingly the third number, *Mycology and Plant Pathology*, written by Prof. S. N. Das Gupta is being released immediately. The reviews on Systematic Botany and Palæobotany are also in press and it is hoped that henceforth we shall be able to publish three or four reviews every year completing the whole project in about four years from now.

DELHI UNIVERSITY,
April 14, 1958.

P. MAHESHWARI,
Professor of Botany.

INTRODUCTION

THE history of modern Mycology in India begins with foreign visitors who in the nineteenth century made stray collections of fungi from the country and sent their specimens to European laboratories for study and identification. Hooker and Thompson's extensive collection, comprising a large number of agarics from the Eastern Himalayas, marks the beginning of a more comprehensive and systematic survey of Indian fungi; agarics from this collection were later described by Berkeley. Another important contribution on similar lines was made by Sulpis Kurz, the then curator of the Royal Botanic Gardens, Calcutta, whose large collection of fungi from Bengal and Burma was described by Currey.

The break from the tradition of sending abroad the Indian fungus collections came from the pioneering efforts of the officers of the Indian Medical Service, of whom the names of D. D. Cunningham and A. Barclay deserve special mention for initiating the local investigation of fungi in this country. Cunningham's contributions deal with the fungi belonging to orders Mucorales, Ustilaginales, and Uredinales; Barclay investigated the rusts occurring in the vicinity of Simla. Amongst the first Indians to take up a scientific study of fungi was K. R. Kirtikar, whose collections and study of fleshy fungi during the last decade of the 19th century marks the beginning of Indian initiative in the field of Mycology.

It was, however, left to E. J. Butler to initiate and organise for the first time on a large scale mycological and phytopathological research in India. During his twenty years' stay in this country, working at the Imperial (now Indian) Agricultural Research Institute at Pusa (now at New Delhi), Butler founded a great research tradition in Mycology and Plant Pathology which set the pattern for future progress in these branches of study. Butler's *magnum opus* " Fungi and Disease in Plants " remains an all-time classic on the subject in India; the later British version of this book entitled " Plant Pathology " by Butler and Jones, derives in a large measure its basic structure and design from the earlier Indian publication. After Butler's departure from India in 1921, work in mycology and plant pathology was carried on by his associates. In the meanwhile, the great significance of research in these fields of study for this country was gradually realised and workers in increasing numbers took up this work. To-day, after 50 years of steady progress, India possesses a large team of trained mycologists and plant pathologists who, working in the various research centres all over the country, are contributing their bit towards the progress of these sciences.

Important amongst the mycological and phytopathological research centres in India to-day are: Indian Agricuitural Research Institute,

New Delhi (Taxonomic Mycology, Plant Pathology including Virology); Forest Research Institute, Dehra Dun (Forest Mycology and Pathology; Polyporaceæ); Kar (formerly Carmichael) Medical College, Calcutta (Polyporaceæ); Botany Departments of Universities of Lucknow (Mycology and Plant Pathology; Mango diseases), Allahabad (Mycology; Physiology of Fungi; Pythiaceæ), and Madras (Soil fungi and soil-borne diseases). Besides these, mycologic and phytopathologic research is being carried out at the Agricultural Colleges at Kanpur, Poona and elsewhere and the Government Departments of Forest and Agriculture in various States.

Taxonomy and Morphology of Fungi

(*a*) *General.*—The development of mycology in India has been reviewed by Bagchee (1939), Chaudhuri (1932 *a*, 1934 *a*, 1936 *a*) and Mitter (1935). Recently Mundkur (1951), in his Presidential Address to the Botany Section of the Indian Science Congress, outlined the progress of studies in taxonomic mycology in India. The present review makes a brief reference to the subject.

The establishment of the Mycology Division with attached herbarium—Herbarium Cryptogamæ Orientalis—at the Imperial (now Indian) Agricultural Research Institute, New Delhi, by Butler made available for the first time in India a well-equipped mycological laboratory with a comprehensive reference library. Exsiccatti of important fungi were obtained from renowned mycologists of the world and fungi from all parts of the country were collected and studied by Butler and his associates. A number of papers on Indian fungi were contributed by Butler (1905, *a–d*, 1918) and Sydow and Butler (1906, 1907, 1911, 1912 and 1916). In the meanwhile, Theissen (1912, 1913) published two papers on the fungi of India. In 1931, Butler and Bisby compiled "The Fungi of India" listing 2,351 species and provided a host index for phytopathogenic forms. A supplement to the "Fungi of India" was published by Mundkur (1938 *d*), raising the total number to 2868 species of fungi known till then from India. A second supplement by Ramakrishnan and Subramanian (1952) listed further additions to the "Fungi of India" comprising 812 species recorded during the period 1938–51, bringing the total number of Indian fungi recorded so far to 3,680.

In addition to the centralised research on Indian fungi at the Imperial Agricultural Research Institute, regional and local surveys were also made by mycologists in different parts of the country. Notes on South Indian fungi were published by McRae (1917), while Mudaliar (1922) gave a historical account of South Indian fungi. Mitter and Tandon published a series of papers on the fungus flora of Allahabad (1930 *a, c*, 1937 *a*), Nainital (1932, 1938) and Mussorie (1937 *b*). Mathur (1936 *a, b*) published notes on the fungus flora of Lucknow and the North-West Himalayas. Chowdhury (1932) recorded the fungi of Lucknow. Uppal, Patel and Kamat (1935) and Uppal, Patel and

Bhide (1949) studied the fungi of Bombay, supplements to which were made by Patel, Kamat and Bhide (1949), Patel, Payak, Gokhale and Kulkarni (1951) and Patel, Payak and Kulkarani (1951). Parasitic fungi of the North-West Frontier Province were reported by Malik and Khan (1943) and those from the vicinity of Banaras, by Payak (1949). Fungi from Assam were recorded by Chowdhuri (1944 *a*, 1948 *a, b*), and from Burma by Rhind and Seth (1945). A comprehensive survey of the fungi of Madras was made by T. S. Ramakrishnan and K. Ramakrishnan (1947 *a–c*, 1948 *a, b*, 1949 *b*, 1950 *a–c*) and T. S. Ramakrishnan (1951 *a, b*, 1952 *b*) and Ramakrishnan, Srinivasan and Sundaram (1952). Ahmed (1949) recently listed some fungi of India and Pakistan.

A number of contributions have been made to the study of soil fungi from different parts of the country. Singh (1932), Singh and Chand (1937), Chand (1937) and Chaudhuri and Sachar (1934) studied the fungus flora of Panjab soils. Galloway (1936 *a*) published a survey of Indian soil fungi. Ghatak and Roy (1939) studied the soil fungi of Bengal paddy-fields. Saksena and Mehrotra (1953) recorded soil fungi of Allahabad while Saksena and Murty (1953) recorded some soil fungi from Saugor. Indian coprophilous fungi were studied by Ginai (1935, 1936). The atmospheric fungal flora of Kanpur was studied by Rajan, Nigam and Shukla (1952).

A series of notes on Indian fungi by Padwick and his associates (1943–46) and papers on the revision of and additions to Indian fungi by Mundkur and Thirumalachar (1946) and Mundkur and Ahmad (1946) were published from the Imperial Mycological Institute, Kew, Surrey. Recently Chona and Munjal (1950 *a*) initiated a series of notes on miscellaneous Indian fungi.

Besides these, a number of studies have been published concerning taxonomy and morphology of special groups of fungi or forms belonging to these groups. The more important among these are briefly outlined below:—

(*b*) *Myxomycetes.*—Myxomycetes have been a much-neglected group of Indian fungi and very few studies of these forms have been published. Extensive collection of myxomycetes was made by Mrs. Drake from Bengal, including Darjeeling, and from Mussorie and other hill stations of U.P. Many of these collections were sent to London and two large collections were left at Calcutta. These collections provided the type material for pioneer records of these fungi from this country. Bruhl and Sen-Gupta (1927) compiled a list of references found in the third edition of Lister's "Monograph of the Mycetozoa" to 161 myxomycete species recorded from India and neighbouring countries. They also described a number of myxomycetes collected by them in Bengal. The two slime-mould collections left by Mrs. Drake at Calcutta were examined, described and sketched by Ahmad (1934 *a, b*) under the supervision of H. Chaudhuri. This study was published in the form of an illustrated monograph on the "Indian Slime-moulds".

Recently Agnihothrudu (1954 *a, b*) contributed two illustrated accounts on seven slime-moulds from Southern India.

(*c*) *Phycomycetes.*—Among Phycomycetes, aquatic forms have been the subject of several studies. The earliest description of the aquatic phycomycetes of India started in 1907 when E. J. Butler gave an account of the genus *Pythium* and some Chytridiaceæ. In this contribution he described the life-history of *Pseudolpidium aphanomyces* obtained from cultures of *Aphanomyces lævis* at Pusa. He found the resting spores of this species of *Pseudolpidium* which was only once before reported by Dangeard. He also described the life-histories of *Olpidiopsis minor* parasitic in *Achlya polyandra* from Dehra Dun, and *Olpidiopsis Schenkiana* parasitic in *Spirogyra* at Pusa. A new species of *Nowakowskiella, viz., N. ramosa* was discovered by Butler on rotting stems of *Triticum vulgare* from Dehra Dun. He gave a detailed account of the vegetative, reproductive and resting stages of this fungus. Butler also described *Synchytrium, Physoderma* and *Achlya* from India. He discovered the genus *Allomyces* in 1911 growing on dead flies in still water at Pusa and in river water at Poona. He described the different developmental stages of this fungus and discussed its affinities in detail. Butler described a number of aquatic species of *Pythium* from India. *P. gracile* parasitic in *Vaucheria aversa* was described from Surat, India. He found it also in *Ricinus communis* at Dehra Dun. As a saprophyte the same fungus occurred in soil and decomposing plant remains at Calcutta. *P. Indigoferæ* was found epiphytic on the leaves of *Indigofera erecta* and was cultivated on boiled stems of the same plant in water at the Royal Botanic Garden, Calcutta. He described *P. proliferum* which is saprophytic on dead insects in water and vegetable debris in the soil from Calcutta and Dehra Dun. Butler (1906 *c*, 1910 *a*) discovered a new species of *Pythium, P. palmivorum,* occurring as a parasite on *Borassus flabellifer, Cocos nucifera* and *Areca catechu* from Godavari. *P. artotrogus* was found by Butler in rotting potato tubers attacked by *Phytophthora infestans* at Calcutta.

After the description of *Allomyces* by Butler in 1911 there came a gap in the studies of the Indian aquatic fungi till 1929 when H. Chaudhuri made one of the most important contributions to the study in this direction. During 1929–47 he collected and described a large number of the water moulds of India along with a few other parasitic Lagenidiales such as *Myzocytium.* His work started with a study of the flagellates and ciliates of the soil from different parts of India. Then in 1931 he studied the life-history and gave a detailed description of *Myzocytium* sp. parasitic on *Spirogyra.* Chaudhuri (1934 *b*) described a new species of *Saprolegnia* parasitic on fish. In 1935 he and his collaborators began studies on water moulds beginning with descriptions of several species of *Saprolegnia, Protoachlya, Isoachlya, Achlya* and *Rhizidiomyces* of which some were new species. They also studied growth characters and the factors influencing sexual and asexual reproductions in these fungi. Chaudhuri and Kochhar (1935 *a, b*) dealt with 20 species of water moulds from Lahore district including many species of *Achlya,* a few forms of *Aplanes* and *Isoachlya, Protoachlya* and *Rhizidiomyces.* Chaudhuri and Lotus (1936) described a

few more forms of Indian water moulds, while Chaudhuri and Singh (1936) described the behaviour of some water moulds in culture. In 1937 further studies of these forms were reported to the Indian Science Congress by Chaudhuri and A. Hamid. Chaudhuri (1942 *a, b*) discovered a new genus of Saprolegniaceæ which he called *Hamidia.*

A. Mitra (1935 *b*) isolated, cultured and studied the morphological and physiological characters of a few forms of aquatic fungi such as *Allomyces arbuscula, Pythium, Achlya, Dictyuchus* and *Aphanomyces.*

Murdia (1939 *a*) published observations on the development of zoosporangium and liberation of zoospore in *Achlya.* Hamid (1942 *a, b*) described a few more forms of water moulds. In 1942 *Olpidium uredinis* was described by Thirumalachar (1942 *b*).

In the year 1947 a most valuable contribution to the study of the Indian aquatic fungi was made by H. Chaudhuri and his associates in " A Handbook of Indian Water Moulds ".

Patel, Kulkarni and Dhande (1949 *a*) started a study on the Synchytriaceæ to which were added the contributions of Payak (1951), Gupta and Sinha (1951), Lacy (1950 *a*).

Lacy (1949) described *Lagenidium entophytum, Entophlyctis bulligera, Chytridium olla* and *Aphanomyces apophysii* (sp. nov.) collected from the vicinity of Patna. In the same year Thirumalachar (1949 *a*) described a species of *Physoderma* parasitic on the leaves of *Limnanthemum indicum.* Studies on three important groups of aquatic fungi, *viz.,* Blastocladiales, Monoblepharidales and Lagenidiales were made by Das Gupta and (Miss) Rachel John (1953 *a-d*).

Besides these aquatic forms, a large number of other phycomycetous fungi have been studied; many of these include phytopathogenic species belonging to the genera *Phythium* and *Phytophthora.* Taxonomic studies on the genus *Pythium* include Butler's (1913 *b*) description of *P. de Baryanum* and Balakrishnan's (1948 *a, b*) reports on five species of *Pythium* from South India, of which one was assigned to a new species *P. indicum,* while the other four, *P. carolinianum, P. paræcandrum, P. periplocum* and *P. catenulatum,* were new records for India. Among the new species of *Phytophthora* described from India, mention may be made of the description of *P. meadii* by McRae (1918 *a*) and *P. himalayensis* by Dastur (1948). Thomas and his associates (1947, 1948) investigated oospore formation in relation to the taxonomy of some species of *Phytophthora.* Thomas *et al.* (*loc. cit.*) concluded that the four species of *Phytophthora,* viz., *P. arecæ, P. meadii, P. faberi* and *P. parasitica* var. *nicotianæ,* be merged with *P. palmivora.* Similarly Thomas and Ramakrishnan (*loc. cit.*) concluded that *P. parasitica, P. parasitica* var. *piperina* and *P. colocasiæ* be combined into one, *P. colocasiæ.*

A comparative study of the species of *Sclerospora* was made by Uppal. Uppal, in collaboration with Weston (Uppal and Weston, 1936), presented reasons for retaining *Sclerospora sorghi* as a separate species which was formerly classed by Kulkarni (1913) only as a variety of *Sclerospora graminicola.* On the other hand, Uppal and Weston

(1936), found that the differences between *Sclerospora indica* and *S. philippinensis* were not sufficient to justify maintaining them as separate species. Production of oospores by *Sclerospora sorghi* on maize was observed by Patel (1949 *a, b*). Species of *Peronospora* occurring in the Punjab were described by Thind (1941 *a*, 1942 *b*).

Ajrekar and Dharmarajulu (1931) studied the Mucorineæ of Bombay. Sinha (1939 *a, b*; 1940 *a, b*) investigated two species of *Choanephora*, viz., *C. cucurbitarum* and *C. trispora*. He made a revision of characters of the fungus *C. cucurbitarum*, and observed several new points in its morphology (Sinha, 1939 *a*, 1940 *a*). Sinha's (1939 *b*, 1940 *b*) study of *Blakeslea trispora* revealed that it was the same as *Choanephora trispora*. Sinha's (1940 *a*) study of the development of " monosporous sporangiola " in *C. trispora* suggested that these were intermediate structures illustrating the derivation of conidia from sporangiola.

Recently S. B. Saksena (1953) described a new mucoraceous fungus isolated from soil. He called the genus *Saksenæa* (after R. K. Saksena of Allahabad University). Discussing the affinities of this interesting fungus, he recalled the suggestion of von JacZewski that the zygomycetes may have been evolved from chytridiaceous fungi.

(*d*) *Ascomycetes*.—The earliest available record of an ascomycete from India appears to be that of Cunningham who identified a perisporiaceous fungus very close to *Meliola* and *Antennaria* causing a sal-leaf blight in the Dehra Dun forests. Since then a large number of ascomycetes have been recorded, and many of them described as new species. In 1911 Butler described a new species of *Taphrina*, viz., *T. maculans*.

Indian species of Aspergilli and Penicillia were listed by Chaudhuri and Umar (1935, 1938) and Chaudhuri (1938) from the Punjab. Chaudhuri (1932 *c*) also reported a case of penicilloid type of conidiophores in *Aspergillus nidulans*. Further addition to the list of Indian Aspergilli was made by deMello (1939). Recently Mohanty (1948) published a list of species and varieties of *Aspergillus* so far recorded from India and discussed the status of these species. He found that out of the 33 species and 2 varieties recorded from India, only 20 species appeared reliable. He also described in detail 6 species of *Aspergillus*, four of them being new records from India and thus raising the total number of Indian Aspergilli at present recognizable to 24 species.

Thirumalachar (1946 *a*) described a new species of *Elsinæ*, viz., *E. bitancourtiana*.

Among taxonomic studies of Erysiphales, the following may be mentioned. Four new species of *Meliola* were described by Stevens (1928). The systematic position of *Oidiopsis taurica* was questioned by Mundkur but Uppal, Kamat and Patel (1937) upheld the validity of this name. Kamat and Patel (1948) recorded some new hosts of *Oidiopsis taurica* and split this highly specialised pathogen into several physiological races.

Several new species have been described among the Sphæriales. Ryan (1928) described five new species of *Asterina* from India. Tunstall (1934) described a new species of *Glomerella*, viz., *G. major*, on the leaves of the tea plant. Verma (1939, 1940) described a new species of *Bombardia*, viz., *B. hyalina*, obtained from the dry twigs of *Thunbergia grandiflora*. Mitra (1943, 1944) described a new species, *Melanopsamma ranjani*, parasitic on *Selaginella chrysocaulos*.

Petch (1924–26) described a number of species of *Cordyceps* from Ceylon. Petch and Bisby (1950) published "The Fungi of Ceylon" wherein 636 genera and various species have been recorded in Ceylon together with an appendix on fungi pathogenic to man. A species of *Cordyceps* collected from Eastern Tibet was studied by Chaudhuri (1931 *b*, 1932 *e*). The morphology of perithecial stages of *Sphærostilbe bambusæ* was studied by Mathur (1936 *a*).

Ergots have received little attention in this country. According to Pushkar Nath and Padwick (1941), the only ergot reported in India till 1941 was *Sphacelia sorghi*, described by McRae (1917) as the cause of a disease of *Sorghum vulgare*. Kulkarni (1942) reported that the first collection of ergot (*Sphacelia sorghi*) on Jowar (*Sorghum vulgare*) was made at Dharwar by him in 1915. It was suggested by Ajrekar (1926 *b*) that this fungus was the imperfect stage of a species of *Claviceps*. From Simla, Padwick and Azmatullah (1943) recorded the occurrence of *Claviceps purpurea* and described a new species, *Claviceps viridis*, occurring on *Oplismenus compositus*. In 1946 Adyanthaya reported for the first time the occurrence of *Sphacelia* on the common fodder grass (*Cenchrus ciliaris*) in South India.

Among the Discomycetes, the confusion regarding the nomenclature of *Tuber zeylanicum* occurring in Ceylon was clarified by Park (1932). A new species of Discomycetes, *Mitrula agharkarii*, was described by Banerjee (1944) from Bengal. Bose (1949) described the morphology of a rare variety of truffle, *Tuber indicum*, collected from Kodaikanal hills, Madras.

(*e*) *Basidiomycetes*: (i) *Ustilaginales*.—The most important contributions to the taxonomic study of Indian Ustilaginales have come from Mundkur, Thirumalachar and Pavgi. An excellent consolidated account of Indian smuts was recently presented by Mundkur and Thirumalachar (1952) in their well-illustrated monograph on the "Ustilaginales of India" published by the Commonwealth Mycological Institute, Kew.

The efforts of Mundkur and his associates have been largely responsible for placing on a sound footing the study of Indian smuts of which 203 species belonging to 21 genera are known as compared to only less than half of this number of smut species recorded till 1931 (as listed in Butler and Bisby's monograph on the "Fungi of India"). Mundkur (1939 *a*) presented a short historical account of the smuts collections made in India and studied a number of these forms. In a series of contributions towards a knowledge of Indian Ustilaginales,

Mundkur (1939 *b*, 1940 *a*) and Pavgi and Mundkur (1948) reported the results of a critical reinvestigation of Indian smut collections. Studies in Indian cereal smuts form the subject-matter of another series of contributions by Mundkur. The first of this series was a paper on cereal smuts and their control by the development of resistant varieties (Pal and Mundkur, 1939). In the eighth paper of this series, Mundkur (1945) listed the common names of Indian smut fungi, their scientific names in conformity with the International Rules of Botanical Nomenclature, and names according to previous practice, together with the probable modes of their transmission. A collection of smuts from the North-western Himalayas was investigated by Mundkur (1944 *b*). He also reported the occurrence of some rare and new smuts from India (Mundkur, 1944 *a*).

Thirumalachar (1950 *a, b*) and Pavgi and Thirumalachar (1951, 1952) contributed a series of notes on the Indian smut fungi. Thirumalachar (1944 *c, d*) described an interesting new genus of smuts from Mysore which he called *Mundkurella*. *Mundkurella* shows unusual features (*viz.*, heterosporous sori, constrictor cells between the promycelial cells, viable one- and two-celled spores) which are not found in any other genus of Ustilaginales. Thirumalachar (1947 *c*) studied the species of the genera *Doassansia*, *Doassansiopsis* and *Burrillia* found in India. Chlamydospore germination and artificial culture of *Ustilago striæformis* from timothy and bluegrass were studied by Thirumalachar and Dickson (1947 *a*). Thirumalachar and Dickson (1949) also studied the cytology and life-cycle of a cypericolous *Entyloma* sp.

Among other morphologic and taxonomic studies of the Indian smut fungi, following may be mentioned : Smuts of the Punjab (Sawhney, 1937; Chaudhuri, 1940), life-history of sugarcane smut, *Ustilago scitaminea* (Luthra, Sattar and Sandhu, 1938). Khanna and Ramnathan (1946) recorded for the first time the occurrence of *Sphacelotheca schweinfurthiana* on "munja grass" (*Saccharum munja*). The first record of the occurrence of a species of *Sphacelotheca* (*S. cruenta*) on sugarcane was made by Chona and Munjal (1951).

Mitra (1931 *a*) recorded a new bunt on wheat in India, which he named *Tilletia indica*. Observations on this smut, renamed *Neovossia indica* (Mitra) Mundkur (= *Tilletia indica*), were recently made by Holton (1949) to elucidate the fundamental differences and similarities between it and the common and dwarf bunts of wheat caused by *Tilletia caries*.

Vaheeduddin (1950) recorded the occurrence of two new physiologic races of *Sphacelotheca sorghi* and published a key for identifying 8 physiologic forms of this grain smut of *Sorghum*.

(ii) *Uredinales*.—Pioneer studies of Indian rust fungi were made by two medical officers of the Indian Army, Cunningham and Barclay. A collection of rusts occurring in the vicinity of Calcutta and elsewhere in Eastern India was made by Cunningham during the years 1875–97. His contributions include a note on the life-history of *Ravenelia sessilis*

and *R. stictica* (Cunningham, 1889) and another note on Indian rusts (Cunningham and Prain, 1896). Barclay (1886–92) contributed a large number of papers on Indian rust fungi, including many descriptions of new species and new records of rusts from this country. Barclay (1887 *c*, 1889 *a*, 1890 *a* 1891 *a, b*) also published a descriptive list of the rusts occurring in the neighbourhood of Simla in the Western Himalayas. Some Himalayan rusts were also studied by Dietel (1890).

In 1910 Butler described a new genus of rust which he named *Cystopsora* from the characteristic basal cells or cysts present in the teleutosorus. Butler (1912) also described two rusts on wild vines of India and in 1914 he published a detailed description of three more rusts, *viz.*, *Kuehneola fici*, *Coleosporium oldenlandiæ* and *Puccinia Kuhnii*.

Ajrekar and his associates made a number of contributions to the studies on Indian rusts. Ajrekar (1912 *a*) described the castor rust *Melampsorella*. He also studied the life-history of *Cystopsora oleæ* Butl. (Ajrekar, 1912 *b*). Life-history of *Uromyces aloes* was worked out by Ajrekar and Tonapy (1922). Ajrekar and Parandekar (1931) made observations on the life-history of *Uromyces* sp. occurring on *Jasminum malabaricum*, and found that this rust was different from the rust, *Uromyces hobsoni*, occurring on *Jasminum grandiflorum*.

Arthur and Cummins (1933) recorded 89 species of rusts (including 5 new species and 2 new combinations) collected in India from Punjab, Kashmir, North-west Frontier Province and in the vicinity of Mussoorie in U.P.

Thind (1941 *b*) made a morphological study of 8 rusts occurring in the Punjab on 9 hosts, of which those occurring on *Asparagus gracilis* and *Grewia asiatica* were new records for the country. In 1942, he (Thind, 1942 *a*) described *Puccinia phyllocladiæ*, the rust occurring on *Asparagus gracilis*.

Mehta's investigations on the epidemiology of cereal rusts form one of the major contributions to rust studies in India (reviewed elsewhere, p. 33). Mehta also studied the morphology and infection histology of the physiological species of *Puccinia graminis* (Mehta, 1924, 1927 *a, b*) and *P. triticina* (Mehta, 1927 *c*). Prasada, a student and collaborator of Mehta, also made a number of contributions to the study of rusts in this country. He recorded the occurrence of æcidial stage of linseed rust, *Melampsora lini* (Prasada, 1940) and the uredo-stage of *Aecidium* found on *Thalictrum* in the Simla hills (Prasada, 1946). Prasada (1947 *d*) discovered the uredo-stage connected with the æcidia so commonly found on species of *Berberis* in the Simla hills. He found that this rust was a new specialised form of *P. graminis* which he designated as *P. graminis agropyri*. Prasada (1948 *b*) also studied the formation and germination of teliospores of several rusts.

Mundkur, Thirumalachar and their associates made many important contributions to taxonomic and morphologic study of Indian rust fungi. New genera of rusts described by this school of workers

include *Catenulopsora* (Mundkur and Thirumalachar, 1943), *Dasturella* (Mundkur and Kheswalla, 1943), *Mehtamyces* and *Santapauella* (Mundkur and Thirumalachar, 1945), *Acervulopsora* (Thirumalachar, 1945 *c*) and *Kernia* (Thirumalachar, 1946 *b*). A new species of *Ravenelia* occurring on *Acacia modesta* was described by Mundkur and Prasad (1938). Mundkur (1943 *d*) also recorded the occurrence of 8 (including 2 new) species of *Phakopsora* and two species (including one new combination) of *Bubakia* from this country.

Thirumalachar (1939) studied the morphology of different developmental stages of *Uromyces hobsoni*, an autœcious rust on *Jasminum grandiflorum*. He also found that the galls induced by the rust *Hapalophragmium ponderosum* on *Acacia leucophalœa* resembled in anatomical and developmental features the common " crown gall " of plants caused by *Bacterium tumefaciens* (Thirumalachar, 1941 *b*). Thirumalachar described a number of new rust species including *Puccinia leiocarpum* (1941 *c*), *Melampsora mundkuri* (1941 *d*), *Didymopsora toddaliæ* and *D. macrospora* (1942 *b*), *Phragmotelium mysorensis* (1942 *c*), *Puccinia chomeliæ* (1942 *f*), *Massecella narasimhanii* (1943 *a*), *Uredo elettariæ* (1943 *b*). Thirumalachar (1947 *b*) investigated two interesting rusts, *Anthomycetella canarii* (a leaf rust on *Canarium villosum*) and the bamboo rust *Stereostratum corticioides* which is characterised by *Corticium*-like telia measuring upto 10 cm. in diameter (largest known sori, so far unknown from among other rust genera).

Thirumalachar (1945 *e*, 1947 *a*, 1950 *c*) published a series of papers describing some noteworthy rusts collected from South India. A careful study of the status of the rust genera *Allopuccinia, Leucotelium, Edythea* and *Ypsilospora* was made by Thirumalachar and Cummins (1948) who reduced the genera *Allopuccinia* and *Leucotelium* to synonymy with *Soratœa*; the genus *Edythea* to synonymy with *Desmella* ; and *Ypsilospora* synonymous with *Chaconia*. Thirumalachar and Cummins (1949) also reviewed the genera *Chaconia, Chrysocelis, Scopella* and *Maravalia*, together with synonymous genera, and found that the taxonomic significance of sporogenous basal cells in the uredia and telia of plant rusts was overemphasized. They did not consider the presence of basal cells of generic significance and presented a key, based on other characters, for a group of genera in which basal cells figured prominently. Thirumalachar and Kern (1949) made a comparative study of some species of *Phakopsora* with related genera, commented on the taxonomic concepts of the group and presented a concise key to the genera *Angiopsora, Phakopsora, Bubakia, Bœodromus, Dasturella, Arthuria* and *Cerotelium*.

The most outstanding contribution to Uredinology from this country was made by Thirumalachar and Mundkur (1949 *a, b*, 1950 *a, b*) in a series of papers on the genera of rusts published in the *Indian Phytopathology*. In this series of papers, they brought together the mass of scattered information regarding 120 rust genera of the world, apart from 10 fossil genera (including 6 doubtful or excluded genera).

T. S. Ramakrishnan and his school of workers have made a number of contributions to the study of South Indian rust fungi. They described a large number of new rust species (T. S. Ramakrishnan, 1950, 1951 *c*; T. S. Ramakrishnan and K. Ramakrishnan, 1947 *d, e*, 1949 *c*; Ramakrishnan and Soumini, 1947 *a*; Ramakrishnan and Srinivasan, 1950 *a*; Ramakrishnan and Subramaniam, 1946 ; and Ramakrishnan and Sundaram, 1952), and established two new genera, *viz.*, *Scopellopsis* (T. S. Ramakrishnan and K. Ramakrishnan, 1947 *d*) and *Gymnopuccinia* (T. S. Ramakrishnan, 1951 *c*). Sunanda Kamath (1947) investigated the life-history of *Puccinia ruelliæ* on *Ruellia prostrata* and studied in detail the succession of the different spore forms and their mode of development.

A new genus of rust, *Kulkarniella*, occurring on *Pavetta tomentosa*, was described by Gokhale and Patel (1951).

Gopalakrishnan (1951) made a comparative study of soral morphology of 32 species of *Hemileia*, including *Hemileia vestatrix*, the well-known cause of a severe disease of coffee leaves. He suggested the division of the genus *Hemileia* into sub-genera on the basis of soral morphology and position. He stressed the importance of primary sori in the classification of rusts and observed that the basal cells and teliospore variations were not sure bases for generic distinction in the Uredinales.

Venkatarayan (1951) analysed the characters distinguishing *Hapalophragmium* from *Triphragmium* and found no reason to separate the two. The creation of a new genus *Hapalophragmiopsis* by Thirumalachar was found to be unnecessary by Venkatarayan who proposed a new combination *Triphragmium ponderosum* to include these forms.

(iii) *Homobasidiomycetes.*—The work on polypores constitutes a significant bulk of the contributions made to the study of *Homobasidiomycetous* fungi in India during the last fifty years. One of the foremost workers on polypores has been S. R. Bose, under whose distinguished leadership the Botanical Laboratory of the Kar (formerly Carmichael) Medical College, Calcutta, developed during the last three decades as the leading centre of research on Polyporaceæ and other fleshy fungi in India.

Bose recorded a large number of polypores from Bengal (Bose, 1921 *a–c*, 1924, 1925) and Assam (Bose, 1937 *c*), some of these being new records for India, and include several new species. He described the geographical distribution and history of polypores in Bengal (Bose, 1922 *a–c*) and studied their distribution at high altitudes (Bose, 1935 *a, b*). He made several contributions to the study of abnormal structures in polypores (1931, 1933 *a*, 1935 *d*, 1936, 1937 *a, b*, 1939 *a*). Bose (1944), from his wide experience of work with polypores, suggested the use of certain characteristic anatomical features for the specific delimitation of these fungi, in addition to the characters of basidia and spores.

Banerjee, of the Botany Department, Calcutta University, in collaboration with several associates, made several contributions to the advance of research on polypores. Agharkar and Banerjee (1933 *a, b*) recorded polypores and other hymenomycetous fungi from Calcutta and its suburbs, and later Banerjee and Ghosh (1945) recorded these fungi from Sikkim, Himalayas.

Working at the Forest Research Institute, Dehra Dun, Bakshi (1952) found *Oedocephalum lineatum* to be the conidial stage of *Fomes annosus*. Bhagwager (1935 *a*) reported a collection of Polyporaceæ of Central Provinces. The polypores in other regions of India have received only a passing attention from mycologists and only stray reports of them appear to exist.

The Agaricaceæ have suffered from a surprising degree of prolonged neglect by mycologists in India, but lately certain amount of interest has been evinced for the study of these fungi. Several contributions have been made from the Botanical Laboratory of the Kar Medical College, Calcutta. S. R. Bose and A. B. Bose (1940) published an account of edible mushrooms of India and pointed out the need for introducing mushroom cultivation in this country. A. B. Bose (1940) made a study of the fairy rings of mushrooms of Calcutta, and Bose (1949 *b*) recorded the occurrence of *Marasmius equicrinus*, an epiphytic horse-hair fungus in Bengal. Bose and Chatterjee (1950) reported a case of an apparent symbiosis of *Lagerstræmia flos-reginæ* with *Marasmius canysanella*.

Thivy (1947) began a study of the systematics and bionomics of the mushrooms of Madras and Moses (1948) made a preliminary report on the mushrooms of Baroda.

The progress made in India in the study of Thelephoraceous fungi has been mainly with regard to the phytopathogenic species which have been recorded, amongst others, by Butler (1918), Narasimhan (1933 *a, c*), Mundkur (1934 *b*) and Dastur (1941, 1946). Amongst the consolidated accounts of this group, mention may be made of Banerjee's (1933 *a, b*) record of the Thelephoraceæ of Bengal and his investigations on their comparative anatomy.

Of the phytopathogenic Thelephoraceæ, the species belonging to the genus *Corticium* are best known in India. A number of important plant diseases are caused by the Rhizoctonia stage of this fungus. Taxonomy and parasitism of Indian species of *Rhizoctonia* was studied by Shaw (1912) and Shaw and Ajrekar (1915). There has been recently certain amount of controversy regarding the validity of the generic name *Corticium* and its subsequent transference to *Pellicularia* made by Rogers (1943), and this led to numerous nomenclatural emendments. Thus Dastur (*loc. cit.*) changed, in the light of Mundkur's (1940 *b*) criticism, the names *Corticium album* and *Corticium salmonicolor* in line with Rogers. Venkatarayan (1949 *b*) recently examined the implications of the revival of the name *Pellicularia koleroga* by Rogers (*loc. cit.*), and suggested that the revival was not proper. He

proposed that the generic name *Pellicularia* Cooke be changed to *Botryobasidium* Donk.

Gadd and Loos (1948) studied the basidiospores of *Exobasidium vexans*, the cause of blister blight of tea leaves in Ceylon. T. S. Ramakrishnan and K. Ramakrishnan (1949 *a*) described six species of *Exobasidium* from South India.

As compared to the Hymenomycetes, the progress made in the study of Gasteromycetous fungi has been relatively less striking. Ahmad recorded a number of Gasteromycetes from the Punjab plains (1939 *a. b*, 1941 *a*) and from the N. W. Himalayas (1941 *b*, 1942), and after the partition of India, published a study of the morphology of *Disciseda cervina* (Lycoperdaceæ) from Pakistan (Ahmad, 1950). Narasimhan (1928 *a*, 1932) recorded a collection of phalloids from Mysore, while Chowdhury and Verma (1944) reported some of these fungi from Lucknow. Iyengar (1937) reported *Clathropsis*, a new genus of Phalloideæ from Madras.

(*f*) *Deuteromycetes.*—Butler and Bisby (*loc. cit.*) observed that " the Fungi Imperfecti are present in India in enormous numbers, and includes many important parasitic groups. Not much work has as yet been done upon them.....Some special study has been given to *Cercospora* (Sydow and McRae, 1930) with the result that 59 species are now known in India..... *Diplodia*, *Phoma*, *Phyllosticta* and *Septoria* are other common genera in India, as elsewhere ".

Considerable progress has been made in the study of Deuteromycetes in India since Butler's time. A number of new records have been made and several new species have been described. The emphasis, however, has been mainly on the study of their physiology and genetics, particularly in the genera like *Fusarium*, *Colletotrichum* and *Helminthosporium* or on plant pathological lines. Amongst the studies of a general nature, mention may be made of Padwick's (1941) paper on the use of field observation in classifying Fungi Imperfecti and Subramanian's (1952 *c–e*) series of three papers recording the Fungi Imperfecti from Madras.

U. B. Singh (1930, 1931, 1934) carried out a series of studies in the genus *Cercospora* and described a new species *C. indica*, causing leaf-spots of *Cajanus indicus*.

Mehta, P. R. (1935 *b*) made a morphological and cultural study of the genera *Vermicularia*, *Colletotrichum* and *Gloeosporium*. He observed that the criteria of classification of these genera, *viz.*, the character of stroma (erumpent in *Vermicularia* and innate in *Colletotrichum*), the number and the distribution of setæ are partly, if not entirely, controlled by environmental factors and are, therefore, of little taxonomic value.

A series of comprehensive studies of the genus *Fusarium* have been made by Padwick. In 1939, he described the known occurrence of

Fusarium in India. He also made a critical study of several phytopathogenic Fusaria (Padwick, 1940 *a, b*).

DaCosta and Mundkur (1947) made a revision of the genus *Phyllosticta.* Their investigations indicate the presence of 7 species which are new records and 6 others which are proposed as new species, raising the total number of species in India from 47 to 60.

Venkatakrishnaiah (1952) recently reported the development of the perithecial stage (*Glomerella psidii*) of *Colletotrichum psidii* in pure culture for the first time from India. Subramanian and Ramakrishnan (1953) investigated in detail the nature of the spore appendage in *Neottiospora.*

There have been several reports of Deuteromycetous hyperparasites during recent years. Amongst these mention may be made of the reports on *Darluca filum,* a Phomaceous hyperparasite of rusts, by Ramakrishnan and Narasimhalu (1941 *b*) from South India and by R. Prasada (1948 *d*) from Simla. Prasada (*loc. cit.*) pointed out that it was useless to attempt to control wheat rusts in the field by *Darluca filum.* Thirumalachar (1942 *d*) reported the occurrence of *Tuberculina costaricana* as a hyperparasite on Jasmine rust (*Uromyces hobsoni*). Venkatarayan (1946 *b*) recorded the occurrence of *Cicinnobolus ceasti* (Phomaceæ), a natural fungus parasite of powdery mildew (*Leveillula taurica*) on *Cyamopsis psoralioides,* for the first time from India. Srinivasan (1951) reported the occurrence of *Monotrichum commelinæ* (Melanconiaceæ) as a hyperparasite on *Kordyana indica* and *K. celebenis* occurring respectively on *Commelina benghalensis* and *C. attenuata.*

Mundkur investigated the development of the perfect stage of *Sclerotium rolfsii* in culture (Mundkur, 1934 *b*) and the parasitism of *Sclerotium oryzæ* (Mundkur, 1935 *a, b*).

A. K. Mitra (1941 *a*) reported the occurrence of *Ectostroma,* a mycelial fungus on living leaves of *Lindsaya cultrata.*

PHYSIOLOGY OF FUNGI

1. *Introduction.*—Concurrent with the changes in trends of mycological research in other countries, in India also there has been a shift in emphasis from morphological to physiological studies of fungi during recent years. In 1923, Shaw emphasized the need for a physiological bias in mycological research. The growing interest of Indian workers in the physiology of fungi during the last twenty-five years is reflected in the increasing number of publications concerning studies on growth, sporulation, nutrition and metabolism of fungi, and the associative effects amongst themselves and with other organisms. The physiology of parasitism by fungi has received particular attention from Indian workers.

2. *Growth.*—Amongst some of the more recent publications on the effect of various physical and chemical factors on the growth of fungi, mention may be made of the studies of Ramakrishnan (1941 *e*)

on *Colletotrichum falcatum*, Chowdhury (1944 *g*) on *Cercospora*, Bhargava (1945 *f–l*) on some members of *Saprolegniaceæ*, Asthana (1947 *a, b, c*) on two species of *Sclerotium* and Raychaudhuri (1947 *d*) on *Diplodia cajani*. Chowdhury (1946 *g*) investigated the effect of pH on the growth and parasitism of *Sclerotium rolfsii*. The effect of aeration on the growth and sporulation of some soil Fusaria was studied by Sarojini (Miss) and Yogeswari (Miss) (1947). Studies by Sinha (1950) on chemical factors affecting the growth of fungi in mangoes suggested a certain degree of correspondence between the growth reaction of the fungi to sugar and acid concentration, and to their power of attacking mango fruits at different stages of maturity. Cultural studies by Hafiz (1951) indicated that the production of concentric zones of pycnidia of *Ascochyta rabiei* on gram pods in nature could perhaps be attributed to the daily fluctuations in atmospheric temperature during infection. Ghosh (1952 *a, b*) studied the influence of temperature and pH on the growth of rice-inhabiting fungi. Tandon and Tandon (1953) observed the effect of sulpha drugs on the growth of *Pestalotia* spp.

3. *Sporulation.*—Sporulation in phycomycetes has been studied with reference to the genera *Phytophthora* and *Pythium*. Saksena (1937) found that development of sexual organs in *Pythium arrhenomanes* could be stimulated by use of special media. Marudarajan (1941) made observations on the production of sex organs in paired cultures of species of *Phytophthora* of the '*palmivora*' group. Desai (1950) studied the relation of food to oospore production in *Phytophthora*. Damle (1953) found that the development of pronounced spines on the oogonia of *Pythium mastophorum* depended entirely on the concentration of the substrate.

Among the ascomycetes, sporulation has been studied with reference to species of yeasts, *Rosellinia*, *Chætomium* and *Eurotium*. Subramanyam (1928) made observations on factors affecting spore formation in yeasts. Das Gupta (1936 *b*, 1937, 1938) studied the cultural behaviour of a species of *Rosellinia* and observed the effect of the various constituents of the substrate on the production of perithecia by this fungus. The influence of nutrient medium on the sporulation of two species of *Chætomium* was observed by Basu (1946). Gupta (1951) investigated the effect of light and temperature on sporulation in *Eurotium herbariorum*.

S. R. Bose (1943 *b*) demonstrated experimentally, for the first time, that basidial transformations in Polyporaceæ were controlled mainly by water-relations of the external environment. Bose (1929 *a, b*), Banerjee and Bakshi (1944), Chakrabarty (1941) and Banerjee and Chakravarty (1945 *a, b*) studied the production of fruit bodies of Polyporaceous fungi in artificial culture.

The effect of pH, various sugars and nitrogen sources on spourlation of *Colletotrichum lindemuthianum* was studied by Mathur, Barnett and Lilly (1950). Mathur's (1951) study of the function of spore matrix in *Colletotrichum lindemuthianum* suggested that by stimulating

asexual reproduction, the matrix in this fungus perhaps helped in the natural spread of bean-anthracnose disease.

4. *Spore germination.*—Spore germination in fungi was investigated, amongst others, by Uppal (1926) who studied oxygen relations of spore germination in some species of Peronosporales, by Chowdhury (1937) who conducted experiments to study the relation of atmospheric humidity to germination of spores of several fungi, and by A. B. Bose (1942 *c*) who studied germination of ergot. Bhatt (1943 *b*) investigated the factors affecting the germination of spore balls of Bajra smut, *Tolyposporium penicillariæ*. Shivapuri (1943) made a comparative study of the effect of different temperatures on the viability of uredospores of several species of *Puccinia*.

Gattani (1950 *b*) observed lysis in germination of uredospores of wheat rusts on media containing 1 ppm. of hydrophilic colloidal sulphur. He proposed a new term, "germinolytic", for such action of a fungicide which produces lysis of the germ tube. Gattani (1951 *a*) also observed some interesting deviations from the normal types of germination of chlamydospores of *Ustilago scitiaminea* induced by varying quantities of colloidal sulphur in the medium.

5. *Nutrition.*—R. K. Saksena and his associates at the Allahabad University have made a number of contributions to the study of fungus nutrition. In 1940 he studied the nutritional requirements of several species of the genus *Pythium* (Saksena, 1940). Bhargava (1945 *f*) found that utilization of polysaccharides by certain species of Saprolegniaceæ was correlated with their ability to hydrolyse them. Bindal and Sreenivasaya (1945) made a quantitative study of the influence of carbohydrate/nitrogen ratio on the formation of diastase by *Aspergillus oryzæ*. The influence of available carbohydrates on ammonia accumulation by *Pythium aphanidermatum* was observed by Saksena and Jain (1947 *a*) and that by *Penicillium notatum* was studied by Mehrotra (1949 *a*). Saksena and Mehrotra (1948) made observations on the carbon requirements of the genus *Pythium*. Mehrotra (1953) also studied the effect of carbon source on the assimilability of ammonium and nitrate nitrogen by *Phytophthora cactorum*.

Nitrogen nutrition of *Phytophthora phaseoli* was studied by Saksena and Bhargava (1943), that of *Pythium* by Saksena and Jain (1947 *b*), that of some species of Saprolegniaceæ by Bhargava (1945 *g*, *l*) and that of *Alternaria tenuis* by Srivastava (1951).

Sulphur and phosphorus requirements of some members of Saprolegniaceæ were studied by Bhargava (1945 *k*). Tandon (1950) investigated the sulphur requirements of two species of *Pestalotia*.

Mundkur (1928) made observations on the importance of iron for the growth of *Fusarium vasinfectum*. The production of involution forms by different yeasts in presence of mineral salts was studied by Subramanyam (1929), while the effect of vanadium on yeast cells was investigated by Sampath (1944). J. Singh (1944) observed the effect of mercury on some common fungi.

The trace element nutrition of fungi with special reference to the effect of boron, zinc and manganese on the growth of species of Fusarium was investigated by (Miss) Yogeswari (1948). Sadasivan (1951) reviewed the work on the role of trace elements in the control of root-infecting fungi.

6. *Vitamins—Growth Factors.*—Murdia (1939 *b*) observed that B-indolyl-3-acetic acid and Phenyl-acetic acid were of no value as growth stimulants to some species of Sarpolegniaceæ. Saksena and Bhargava (1941 *a*) and Bhargava (1945 *i*) found that certain species of Saprolegniaceæ studied by him could synthesize their own thiamin, production of which was greater in darkness than in light. They also noted that while some vitamins had no effect, others even retarded the growth of these fungi.

Saksena (1939, 1941 *a, b*) found that several species of *Pythium* could manufacture their own growth-promoting substance from the elementary ingredients of the nutrient solutions in which they were grown, and that they did not require any growth supplement from extraneous sources. Similar observations were made by Saksena and Varma (1945 *c*) with reference to 15 other species of *Pythium*, and by Saksena and Dayal (1945) with reference to *Achlya dubia, Aphanomyces camptostylus* and *Thraustotheca clavata.* Saksena (1941 *b*) found that *Pythium indigoferæ* required an extraneous supply of a complex of growth-promoting substances for its growth. Mehrotra (1951) found that the growth of some species of *Phytophthora* was unaffected by growth factors which stimulated the growth of higher plants.

Partial vitamin deficiencies in four strains of *Colletotrichum lindemuthianum* were investigated by Mathur, Lilly and Barnett (1949). Chowdhury and Kamal (1950) observed the effect of B-indol-3-acetic acid, Phenoxy-acetic acid and B-Naphthoxyacetic acid on the growth of *Alternaria tenuis.*

7. *Enzymes.*—Thakur and Norris (1927) studied the conditions under which the enzyme secreted by *Aspergillus flavus* produced ammonia from amino acids. G. Singh (1932 *b*) made observations on the cellulose decomposing power of a number of soil fungi.

Saksena and Bose (1944) investigated the enzymes of two water moulds, *Achlya dubia* and *Thraustotheca clavata.* Bhargava (1945 *h*) observed the inability of some species of Saprolegniaceæ to hydrolyse fat. Some important enzymes of *Phytophthora* spp. were investigated by Mehrotra (1949 *b*), while enzymes of some species of *Pythium* were studied by Saksena and Jafri (1950).

Based upon their enzymatic activity, the wood-destroying fungi were classified into two groups by Banerjee and Chatterjee (1945 *c*): 'white rot' fungi (which attacked both lignin and cellulose) and 'brown rot' fungi (which attacked cellulose only).

The polygalacturonase activity of three strains of Aspergilli was investigated by M. S. Pavgi and his associates (1951). Krishnan (1951)

described the biochemical properties of apyrases produced by *Aspergillus niger* and *Penicillium chrysogenum*.

Several important contributions have been made to the study of the enzymes of phytopathogenic fungi. The relationship of pectinase secretion by fungi to their parasitic action was investigated by Vasudeva (1930 *a*) and Chona (1932 *a*, 1933 *c*). Menon (1934) made a comparison of enzymatic extracts obtained from the various parasitic fungi. Pectinase activity of two species of *Sclerotium* was studied by Asthana (1947 *c*). The role of protopectinase in the wilt syndrome of *Verticillium*-infected cotton plants was recently worked out by Kamal (1954).

8. *Associative Effects—Antibiotics.*—Associative effects in fungi amongst themselves and with other organisms have been the subject of several studies. Vasudeva (1930 *b*, 1933, 1935 *a*) investigated the effect of one organism on the parasitic activity of the other and explained these effects on the basis of stating phenomenon. Asthana (1936) studied the antagonistic action of several fungi and their culture-filtrates on the germination, growth and parasitic vigour of *Botrytis cinerea*.

Study of growth reactions of several non-parasitic fungi in associated cultures by Sadasivan (1939 *a*) showed that the presence of a mere inoculum of one fungus may, in certain cases, modify the growth reaction of another.

Lal (1939) investigated the interaction of soil micro-organisms with *Ophiobolus graminis*, the fungus causing the take-all disease of wheat. His studies suggested that the activity of several soil micro-organisms, particularly *Trichoderma lignorum*, conditioned the percentage of recovery of the pathogen from roots subsequent to inoculation. This effect was found most marked in acid soils. Antagonistic action of *Trichoderma lignorum* on *Colletotrichum falcatum* in paired cultures was observed by Ramakrishnan (1941 *e*). Ramakrishnan (1941 *e*) also found a species of *Aspergillus* and its autoclaved extract to have a similar inhibiting effect on the cultures of *Colletotrichum falcatum*.

Antibiotic activity of several soil bacteria to *Helminthosporium sativum* and *Fusarium lini* was observed by Anwar (1949). Chakraborty and his associates (1952) observed the antibiotic activity of some fungi and actinomycetes isolated from soil.

Gupta and Price (1950) studied the production of plant virus inhibitors by fungi. They found that the extracts of *Trichothecium roseum* reduced the ineffectivity of southern bean mosaic, tobacco mosaic and tobacco necrosis viruses.

Though there have been several publications on the antibiotic activity of fungi, the antibiotics as such have received very meagre attention in this country. Bose and Choudhury (1944) isolated polyporin from the filtrate of a culture of *Polyporus* and found the clinical trials of the crude filtrate encouraging. Gattani and Kaul (1949) devised an apparatus and conducted experiments to test the penicillin producing capacity of strains of *Penicillium* occurring in soil.

9. *Physiology of parasitism.*—An analysis of the factors underlying the specialisation of parasitism with reference to the fungi *Botrytis allii* and *Monilia fructigena* was made by Vasudeva (1930 *a*). He found that the effect of nitrogenous compounds in stimulating invasion by the spores of *B. allii* was parallel to its action in promoting the secretion of the pectinase enzyme by the fungus. Chona (1932 *a*, 1933 *c*) also found that the factors underlying the specialisation of parasitism of fungi infecting apple and potato were those which affected the activity of pectinase enzyme.

The physiology of parasitism by *Colletotrichum lindemuthianum* was studied by Dey (1919) who found that host penetration by this pathogen was effected in a mechanical manner similar to that occurring in infection by *Botrytis cinerea.* Parasitism of *Colletotrichum indicum* infecting cotton bolls was studied by Ramakrishnan (1941 *c*).

The physiology of wilt diseases caused by fungi has been the subject of several studies. Mundkur (1935 *c*) investigated the influence of temperature and maturity of sunn-hemp and pigeon-pea on wilt caused by *Fusarium vasinfectum.* The physiology and biology of this pathogen was also studied by Uppal and Kulkarni (1937). Toxins excreted by the *Fusarium* causing cotton wilt and their influence on the host plants was studied by Kulkarni and Mundkur (1925). Vasudeva (1937 *b*) and Vasudeva and Ashraf (1939) studied the bearing of soil moisture and temperature on the incidence of root rot disease of cotton. Desai and Likhite (1936) and Luthra, Vasudeva and Ashraf (1940) studied the physiology of cotton wilt pathogens. Kalyanasundaram (1952) found that vascular wilts caused by *Fusarium* brought about a striking reduction in the ascorbic acid content and reducing sugars. The role of protopectinase in the wilt syndrome of *Verticillium*-infected cotton plants was recently worked out by Kamal (1954).

The influence of soil conditions on plant diseases has been investigated by several workers. The effect of manurial treatments of soil on *Rhizoctonia* infection of jute was studied by Finlow (1918), that on *Phytophthora* foot rot and leaf rot by Chowdhury (1944 *c*) and that on white rot of onions caused by *Sclerotium cepivorum* by Asthana (1945). Chowdhury (1948 *d, e*) investigated the effect of soil treatments and temperature on the wilt of *Piper betle* caused by *Sclerotium rolfsii.*

Sadasivan and his school of workers at the Madras University have carried out a series of important studies on the physiology of soil-borne diseases. The work done by this school on tropical cultivated soils in relation to soil-borne Fusarioses was recently reviewed by Sadasivan and Subramanian (1954). Studies on soil conditions and root diseases by (Miss) Sulochana (1952 *a–d*) showed that the colonization and survival of the various bacteria, actinomycetes and fungi (particularly Fusaria) was significantly affected by the presence of micro-elements, Zn, Mo, Li, Al, Ni, B, Co and Mn. Sulochana (1952 *d*) found that whereas Zn was effective in reducing the incidence of wilt caused by *Fusarium vasinfectum*, Mn considerably aggravated the incidence of wilt.

Subramanian's (1950) study of the influence of soil conditions on the wilt disease of cotton caused by *Fusarium vasinfectum* showed that microbial antagonism played a role in the colonisation of the pathogen in soil.

Agnihothrudu (1953), in his study of soil conditions and root diseases, found that the rhizosphere microflora was greater than that in the control soils. The " rhizosphere effect " was found to decrease in the following order on Bacteria > Fungi > Actinomycetes. He also observed that while maximum " rhizosphere effect " on bacteria was during the time of flowering, fungal numbers increased after the flowering of crop plants.

The effect of temperature and light on the mesothetic reaction of oats to stem rust was investigated by Hingorani (1951 *a*).

10. *Fungus Ecology.*—Dastur (1917) made observations on the conditions influencing the distribution of potato blight in India.

During his extensive work on Indian polypores, Bose (1922 *b, c*) described the geographical distribution and a short history of polypores in Bengal. He also studied the high altitude (8–10,000 ft. elevation) distribution of polypores in Lokra Hills of Assam (Bose, 1935 *a, b*).

Competition in fungi was investigated by Sadasivan (1938). He also studied the succession of fungi decomposing wheat straw in different soils (Sadasivan, 1939 *b*).

Saluja (1941 *a*) observed the seasonal distribution of five species of *Aspergillus* isolated from the atmosphere.

Dutta and Chaudhuri (1944) made an ecological survey of fungal flora of Kellar soils and made observations on the reduction of carbohydrates by them.

Cytology of Fungi

Studies on the cytology of the genus *Pythium*, species of Saprolegniaceæ and some related lower Phycomycetes by Saksena and his school of workers at Allahabad, studies on the cytology of polyporaceous fungi by Bose at Calcutta, and studies on the cytology of yeasts by workers in South India led by Subramaniam, and cytological study of smuts and rusts by Thirumalachar are amongst some of the principal contributions to cytological research on fungi from this country.

Saksena (1936, *et seq.*) and his associates investigated the various aspects of physiology and cytology of species of *Pythium*. In 1936, Saksena studied the structure of the nucleus in the genus *Pythium*. Saksena and Varma (1945 *a*) observed the action of vital dyes on *Pythium artotrogus* and *P. leucosticton*. Saksena and Varma (1945 *b*) also made observations on the origin and evolution of the vacuolar system of these fungi. The chondriosome system of a number of species of *Pythium* was studied by Saksena and Bose (1945 *a*, 1948). In his Presidential Address to the Botany Section of the 40th Session of

the Indian Science Congress at Lucknow, Saksena (1953) gave a comprehensive review of the researches on physiology and cytology of Pythiaceæ.

Saksena and Bhargava (1941 *a, b*) made observations on the cytology of *Saprolegnia delica*. The finer structure of the cilia of *Thraustotheca clavata* and its phylogenetic significance was studied by Saksena, Bhargava and Dayal (1943). Saksena and Bose (1945 *b*) observed the action of vital dyes on *Achlya dubia* and *Thraustotheca clavata*. Bhargava (1944, 1945 *a*) made observations on the fertilization and oogenesis in *Isoachlya anisospora* var. *indica*. He also investigated the formation and liberation of zoospores in this fungus (Bhargava, 1945 *b*, 1951 *a*). Bhargava (1945 *c, d, e*) carried out a series of studies on the cytology of some members of Saprolegniaceæ with regard to the action of vital dyes, the origin and development of the vacuolar system, and the temperature and chemical effects on the chondriome system. The vacuolar and mitochondrial systems in spore formation in *Thraustotheca clavata* were studied by Saksena and Bhargava (1946). Saksena, Varma and Mehrotra (1949) made observations on the vacuolar system of some members of Saprolegniaceæ and Pythiaceæ. Mehrotra (1948) studied the chondriome of 11 species of *Phytophthora*.

Thirumalachar, Whitehead and Boyle (1950) studied the gametogenesis and oospore formation in *Cystopus* (*Albugo*) *evolvuli* and it was indicated that reduction division occurred at the time of the second of the first two divisions of fusion nucleus of the young oospore. Safeeulla (1953) studied the nuclear changes occurring in sporangia and oospores of species of *Albugo* occurring on *Ipomœa aquatica* and *Merremia emarginata*.

Cytology of yeasts has been the subject of several studies. Srinath (1946 *a, b*) studied the cytology of yeasts and described the chromosomes of *Saccharomyces cerevisiæ*. Naidu and Bakshi (1946) referred to the existence of uncertainty as to the exact number of chromosomes in *Saccharomyces cerevisiæ* and pointed out some discrepancy in the work of Srinath (1946 *b*). The work of M. K. Subramaniam (1945, *et seq.*) and his associates on yeast cytology is of particular significance. Subramaniam and Ranganathan (1945 *a*) investigated mitosis during budding in *Saccharomyces cerevisiæ* and reported that there were only two chromosomes, both identical in appearance. Subramaniam and Ranganathan (1945 *b*) also presented evidence suggesting that the different chromosome numbers of *S. cerevisiæ*, ranging from two to eight as observed by different workers, may perhaps involve polyploidy induced by acenaphthene employed by them in their studies. Induction of polyploidy in *S. cerevisiæ* was further investigated by Subramaniam (1945). Subramaniam (1951 *a*) replied to the technical criticism made by certain authors with regard to the induction of polyploidy and description of centrosomes and chromosomes reported earlier by Ranganathan and Subramaniam (1947). Royan and Subramaniam (1952) presented critical evidence for somatic doubling

of chromosomes in a top yeast and reiterated that somatic doubling of chromosomes was as common in yeasts as in higher plants.

Abnormal mitoses in tetraploid yeasts were studied by Subramaniam (1953). Prahlada Rao and Subramaniam (1953) noted striking differences between cytological pictures observed in cells taken from cultures on agar slants and that observed in actually proliferating yeast cells taken from well-aerated media. They emphasised that the behaviour of the yeast nucleus under aerobic proliferation alone should be taken as the standard for the evaluation of the changes under different cultural conditions (Prahlada Rao and Subramaniam, *loc. cit.*).

Cytology of smuts has been investigated by several workers. Cytology of *Tilletia tritici* was investigated by Dastur (1920 *c*). Das Gupta and Bhatt (1944) studied the behaviour of the nucleus in the mycelium during different phases of spore-ball formation in *Tolyposporium penicillariæ*, a smut of Bajra. Bhatt (1944 *b*) also studied the cytology of germination of the spores of this smut. In 1948 Das studied the morphology of *Tilletia holci* and made observations on the cytology of promycelium and chlamydospore stages. Das (1949) also studied the morphology and cytology of two other Tilletiaceous smuts, *viz.*, *Entyloma microsporum* and *Urocystis anemones*. The cytology and life-history of a cypericolous *Entyloma* species was investigated by Thirumalachar and Dickson (1949).

Thirumalachar has made a number of cytological studies on rust fungi. In 1938 he described the cytology of different spore forms including germination of teleutospores of *Uromyces hobsoni*. He also described a new method of germinating and staining teleutospores of *Uromyces hobsoni* and *Hapalophragmium ponderosum* (Thirumalachar, 1940). Later he (1942 *c*) studied the initiation of the dicaryon phase in the æcia of *Phragmotelium mysorensis*, a new species of rust occurring on Indian raspberry (*Rubus lassocarpus*). He also studied the morphology and cytology of the rust *Chrysocelis ascotela* comb. nov. on *Hedyotis stylosa* (Thirumalachar, 1942 *a*). The development of spore forms and the nuclear cycle in the autœcious rust *Cystopsora oleæ* was studied by him (Thirumalachar, 1945 *d*). He (Thirumalachar, 1946 *d*) made a cytological study of *Uromyces aloes*. The development of the teleutospores of *Ravenelia mitteri* in relation to the nuclear condition was studied by Chowdhury and Pant, in 1953.

Observations on the golgi bodies in higher fungi were made by Bose (1928 *b*, 1929 *c*). (Bose 1932 *b*, 1935 *d*) also studied the cytology of secondary spore formation in *Ganoderma* and he investigated the cytology of basidia in eleven species of *Polyporaceæ* (Bose, 1937 *d*).

Genetics of Fungi

The principal lines of research on fungal genetics by Indian workers include the study of cultural variation, saltation, mutation and sexuality in fungi. The study of saltation in fungi by Das Gupta and the study of yeast genetics by Subramaniam and his associates are among the more outstanding contributions on the subject.

Saltation in *Colletotrichum biologicum* and in a species of *Aspergillus* was investigated by Chaudhuri (1924, 1930 *d*). Chaudhuri (1931 *c*) studied nutritive saltation in fungi and observed that unless it be a rare case of mutation, saltation was purely a nutritive phenomenon.

Mohendra (1928 *b, c*) studied the changes undergone by *Neocosmospora vasinfecta*, *Alternaria tenuis* and two strains of *Phoma* in artificial cultures. Mohendra (1928 *a*) and Mohendra and Mitra (1930) investigated cultural variation in *Sphaeropsis malorum*. M. Mitra (1930 *c*, 1931 *b*) studied saltation in the genus *Helminthosporium*. Mitter (1929 *b*) studied saltation in the strains of section discolor of the genus *Fusarium*. The occurrence of 'false sectors' in cultures of *Fusarium fructigenum* was studied by Vasudeva (1930 *c*). A. Mitra (1934 *a, b*) investigated saltation in six species of *Fusarium*.

Luthra and Bhandari (1932 *a*) studied variation in *Alternaria brassicæ*. Variation in *Ascochyta rabiei* was studied by Luthra and Bedi (1937) and Luthra, Sattar and Bedi (1939). P. R. Mehta (1935 *a*) made a cultural study of *Acrothecium*. The effect of X-rays on *Glœosporium* was observed by J. Singh (1933 *b*).

A comprehensive study of saltation in fungi, with particular reference to that occurring in *Cytosporina*, *Phomopsis* and *Diaporthe*, was made by Das Gupta (1930 *et seq.*). Horne and Das Gupta (1929) found that saltation occurring in every cultural generation of an 'eversaltating' strain of *Diaporthe* was conditioned by the age of the mycelium. In *Cytosporina ludibunda*, Das Gupta (1930) observed that the occurrence of nuclear segregation at the time of pycnospore formation in pycnidia from heterokaryotic mycelium sometimes resulted in variation of characters of pycnospores from a single pycnidium. He also demonstrated the occurrence of true mutation in the ascospores of *Diaporthe perniciosa* (Das Gupta, *loc. cit.*). Das Gupta (1933 *a*) studied the variation in pathogenicity of saltants of *Cytosporina ludibunda* where he found the most virulent saltant of the fungus penetrating the host 50 times as quickly as the weakest sister culture. In *Diaporthe perniciosa*, Das Gupta (1934) found that single spores could give rise to really pure cultures only when the cells of the conidium contained genetically similar nuclei. Das Gupta (1934) also demonstrated the occurrence of vegetative segregation of nuclei in the heterokaryotic mycelium of *Diaporthe perniciosa*. Das Gupta's (1936 *c*) monograph on 'Saltation in Fungi' presents a review of the saltation phenomenon from various stand-points, discussing the types of saltation, induction of saltation by different chemical and physical agents, morphological and physiological differences between the parent and the saltants, variation in the pathogenicity of the saltants and compares saltation in fungi with the phenomenon of bud variation and chimæras in higher plants.

Among other studies on saltation in fungi, mention may be made of the work of Rafay and Padmanabhan (1941, 1947) on *Colletotrichum falcatum*, that of Ramakrishnan (1941 *c*) on *Colletotrichum capsici*, and that of Raychaudhuri (1947 *c*) on *Helminthosporium oryzæ*.

In 1950, Raiay described the cultural characters of a few new types of *Physalospora tucumanensis*. Chattopadhya and Chakraborty (1952) studied the variations in conidial characters of strains of *Helminthosporium oryzæ* collected from different parts of the world. Variability of *Sclerotinia fruticola* was studied by Thind and Keitt (1949) who found that four genetically distinct pairs could be distinguished among the monoascosporic cultures. Chona and Hingorani (1950 *a*) made a comparative study of three typical isolates of *Colletotrichum falcatum*. They also demonstrated mutation in some isolates of this fungus and observed that the frequency of mutation increased with the age of the cultures (Chona and Hingorani, 1950 *b*). Padhi (1953) made observations on *Alternaria*-like mutation of *Stemphylium* and suggested phylogenetic relationship between the two genera.

Some recent studies on fungal genetics in this country have been concerned with the investigation of yeasts. Subramaniam and Ranganathan (1947) studied the induction of mutations in yeast by low temperatures. Subramaniam and his associates, during their studies on the mutagenic action of chemical and physical agents on yeasts, observed the effect of camphor on fermenting yeast cultures (Subramaniam and Sreepathi Rao, 1952) and the effect of ultra-violet irradiation on a diploid brewery yeast (Duraiswami and Subramaniam, 1952). Subramaniam (1951 *b*) made observations on the genetical aspects of the relation between nature and nurture yeasts.

An analytical study of the phenomenon of long term adaptation of *Saccharomyces* to galactose was made by Mundkur and Lindegren (1949). Lindegren and Lindegren (1951) contributed a paper to the 'Indian Phytopathology' on the 'Linkage relations in *Saccharomyces* of genes controlling the fermentation of carbohydrates and the synthesis of vitamins, amino acids and nucleic acid components'.

Sex phenomenon in fungi has been the subject of several studies. Heterothallism in a species of *Mucor* was studied by Ajrekar and Dharmarajulu (1929) and that in *Phytophthora arecæ* and several other strains by Narasimhan (1930). S. R. Bose (1933 *b*) made observations on the theories of sex in fungi in the light of his work on polypores. Mitter (1936), in his Presidential Address to the Indian Botanical Society, discussed heterothallism in fungi. Vaheeduddin (1937) carried out intergeneric hybridization between *Sphacelotheca cruenta* (loose smut of *Sorghum*) and *Sorosporium reilianum* (head smut of *Sorghum*) and found that the hybrid was fertile and heterothallic. Hingorani (1951 *b*) carried out selfing studies with race 7 of *Puccinia graminis avenæ* with a view to furnish an indication of what might happen in nature when races infect barberry and thus enable one to predict to a certain extent the pathogenic characteristics of new races that might be expected to arise in nature from new combination. His results indicated that the race 7 was relatively homozygous with respect to factors for pathogenicity. A paper on the significance of some sexual phenomena in fungi was contributed by Whitehouse (1951) in the 'Indian Phytopathology'.

FUNGUS DISEASES OF PLANTS

The large variety of fungus diseases of plants, particularly those of agricultural crops, play an important role in the national economy. No adequate economic survey of losses caused by fungal pathogens in India is available, but it is estimated that the loss due to one disease alone, *viz.*, the wheat rust, runs into Rs. 60,000,000. In a predominantly agricultural country like India, therefore, phytopathological research assumes particular significance. Chaudhuri (1936 *a*) outlined the need for the control of plant diseases and suggested a scheme for dissemination of phytopathological knowledge to the cultivators. Dastur (1947), reviewing the place of mycology in the economic development of India, referred to the role of fungi as pathogens of plants and animals.

A short history of phytopathology and plant disease control methods practised in ancient India was presented by Chaudhuri (1934 *a*). The modern organised study of fungus diseases of plants in this country, however, dates from the time of arrival of Butler. Butler's (1918) treatise on 'Fungi and Disease in Plants' presents the first consolidated and comprehensive account of the fungus diseases investigated in India during the first two decades of the present century. A more recent account of the principal fungus diseases of plants occurring in India was presented by Mundkur (1949). Sattar and Hafiz (1952) published a monograph embodying the "Researches on Plant Diseases in the Punjab". The present review, outlines very briefly the studies on plant diseases caused by the various groups of fungi.

(*a*) *Diseases caused by Phycomycetes.*—Among Phycomycetes, a number of species of chytrids causing plant diseases of little or no economic importance have been recorded from this country. Among these, mention may be made of *Olpidiopsis minor* and *O. schenkiana* parasitic on *Achlya polyandra* and *Spirogyra* respectively (Butler, 1907 *a*); a species of *Myzocytium* parasitic on *Spirogyra* (Chaudhuri, 1931 *a*); *Chytridium olla* parasitic on *Oedogonium* sp., and *Lagenidium entophytum*, *Entophlyctis bulligera* and *Aphanomyces apophysii* on *Spirogyra* (Lacy, 1949). Lacy (1950 *a*) also described four new species of *Synchytrium* parasitic on higher plants. A new species of *Synchytrium*, viz., *S. phaseoli*, was found by Patel, Kulkarni and Dhande (1949 *a*) to cause a severe defoliation of plants of *Phaseolus mungo*. Payak (1951) found *Synchytrium ajrekari* to cause a severe infection of leaves of udid beans. An interesting case of hyperparasitism was observed by Thirumalachar (1942 *b*) in the infection of urediospores of *Hemileia canthii* by *Olpidium uredinis*. Thirumalachar (1948 *b*) also recorded some chytrid-caused diseases of several species of Bryophytes. He (Thirumalachar, 1949 *a*) found *Physoderma limnanthemi* sp. nov. to produce galls on leaves of *Limnanthemum indicum*. *Physoderma aeschynomenis* was found to incite the formation of large galls on the submerged parts of *Aeschynomene indica*, the pith plant (Thirumalachar and Whitehead, 1951).

Species of *Pythium* cause a number of diseases of economically important plants. McRae (1911) studied the soft rot of ginger caused

by *P. gracile*. Diseases caused by *P. deBaryanum* were described by Butler (1913 *b*). Foot rot of sugarcane caused by *P. deBaryanum* was studied by Ramakrishnan (1941 *a*). *Pythium* diseases of ginger, tobacco and papaya were studied by Subramaniam (1919). He also described wheat-root rot caused by *P. graminicolum* (Subramaniam, 1928). *Pythium aphanidermatum* has been found to cause a number of diseases, including fruit rot of cultivated cucurbits (Mitra, 1927 *a*; Mitra and Subramaniam, 1928), wet rot of cladodes of *Opuntia dillenii* (Ayyar, 1929), stem and foot rot of *Carica papaya* (Bhargava, 1941), collar rot of pigeon pea (Malik, 1945), damping-off of caboage, cauliflower and knolkhol (Mahmud, 1950 *b*), and damping-off of tomato seedlings (Gattani and Kaul, 1951). Verma (1946) described a soft rot of radish caused by a species of *Pythium*. Singh (1946) reported a *Pythium* collar-rot of field pea. Fruit rot of *Hibiscus esculentus* due to *Pythium indicum* was investigated by Balakrishnan (1948 *a*). T. S. Ramakrishnan (1949 *b*) studied the occurrence of *Pythium vexans* in South India where it has been observed to cause diseases of ginger, cardamom, *Pelargonium*, cinchona and apple trees.

Species of *Phytophthora* cause a number of important diseases of palms in this country, including the 'koleroga' or 'mahali' disease of betel palms (Butler, 1906 *c*; Sundararaman and Ramakrishnan, 1924; Venkatarayan, 1932, Uppal and Desai, 1939); bud rot of palmyra palms (Butler, 1906 *c*; McRae, 1912); bud rot of coconut palms (Shaw and Sundararaman, 1914 *a*, *b*; Sundararaman, 1924). McRae (1923 *a*, *b*) showed that the pathogen, *Phytophthora palmivora*, causing bud rot of both palmyra and coconut palms, could pass from one host to the other. The relationship between the Phytophthoræ associated with the bud rot of palms was studied by Gadd (1927). *P. palmivora* has also been found to cause the gummosis of Citrus trees (Kamat, 1927 *a*, *b*; Uppal and Kamat, 1936), seedling blight of *Cinchona ledgeriana* (Kheswalla, 1935), leaf fall and fruit rot of oranges (Devarajan and Aiyappa, 1944), seedling blight of *Hibiscus esculentus* (Balakrishnan, 1947 *b*) and safflower (Balakrishnan and Krishnamurthy, 1947), and fruit rot of tomatoes (Ramakrishnan and Soumini, 1947 *b*).

Phytophthora disease of the para rubber tree, *Hevea brasiliensis*, was investigated by Dastur (1916 *a*) and McRae (1918 *b*, 1919). McRae (1918 *a*) described the pathogen as a new species, *Phytophthora meadii*.

Butler and Kulkarni (1913) investigated the leaf blight and corm rot of *Colocasia antiquorum* caused by *Phytophthora colocasiæ*.

Dastur (1913) described a new species, *Phytophthora parasitica*, causing seedling blight of castor oil plant. *P. parasitica* has been found to cause diseases of a number of other plants, including *Vinca rosea* (Dastur, 1916 *b*) and *Boucerosia diffusa* (Agharkar and Banerjee, 1932 *a*), damping-off of cotton seedlings and fruit rot of guava (Mitra, 1929), and black shank of tobacco (Mundkur, 1937), foot rot and leaf rot of *Piper betle* (Dastur, 1935; Chowdhury, 1944 *c*; Asthana, 1947 *d*), and heart or stem rot and wilt of pineapple (Chowdhury, 1945 *c*, 1946 *b*).

Dastur (1915 *a*) reported that potato blight due to *Phytophthora infestans*, though not common in the Indian plains, was found in the hills. This disease causes severe damage to crops grown in hills at an elevation of 6,000 ft. and above. In Simla hills where potato crop becomes badly damaged every year by *P. infestans*, Dastur (1948) discovered two new diseases of potato, *viz.*, leaf rot caused by a species not much different from *P. parasitica* and tuber rot caused by a new species, *P. himalayensis*. Lal (1948) listed the reports of occurrence of potato blight in the plains of India. The occurrence of this disease in the plains of U.P. and Bihar was surveyed by Vasudeva and Azad (1949 *a*).

White rust of crucifers, *Cystopus candidus*, occurs as a common disease of cabbage, turnip, mustard and radish, but, as Mundkur (1949) pointed out, the modes of perpetuation and transmission of the disease and its predisposing factors have been only little investigated. Besides *C. candidus* and *C. ipomoeæ panduratæ* on *Ipomoea pestigridis* (Verma, 1937), several new species have been reported including *C. evolvuli* on *Evolvulus alsinoides* (Damle, 1943), *C. intermediatus* on *Cardamine submellata* (Damle, 1944) and *C. molluginicola* on *Mollugo nudicaulis* (Ramakrishnan and Ramakrishnan, 1950 *b*). Kar (1951) studied the occurrence of white rust (*Albugo* sp.) on *Amaranthus polygamus* and found that the disease incidence was strictly influenced by atmospheric temperature. He also suggested that oospores, which were plentiful and whose external appearance indicated that they may withstand unfavourable conditions and pass through a resting stage, could be the probable source of infection.

Green ear disease of bajra (*Pennisetum typhoideum*) caused by *Sclerospora graminicola* has been the subject of several studies. Uppal and Kamat (1928) accomplished artificial infection of the disease under very humid conditions. The occurrence of physiologic specialisation in *S. graminicola* was indicated from the studies of Uppal and Desai (1932 *a*) who found that while one race of the pathogen was restricted to *Pennisetum typhoideum*, the other race occurred on species of *Setaria*. A survey of the green ear disease of bajra in low lying bajra fields by Mitter and Tandon (1930 *b*) at Allahabad showed heavy incidence of green ear disease, whereas in fields at higher levels the incidence was very low. Studies by Chaudhuri (1928, 1932 *b, f*) showed that the oospores in the soil were responsible for the propagation of the disease. Studies in the green ear disease of bajra were carried out by Rai (Unpublished) with reference to the disease incidence in fields at high and low levels, factors affecting germination of oospores of the pathogen, and the effect of growing bajra in infected fields for successive years.

The downy mildew of maize caused by *Sclerospora maydis* was investigated by Butler (1913 *a*). The production of oospores by *Sclerospora sorghi* on maize was studied by Patel (1949 *a, b*).

The downy mildew of jowar (*Sorghum vulgare*), formerly considered to be a variety of *Sclerospora graminicola* (Kulkarni, 1913), was

described as a distinct species, *S. sorghi*, by Weston and Uppal (1932). Ayyangar and Hariharan (1934) reported the suppression of the awn in *Sorghum* due to *Sclerospora* disease. The occurrence of the green ear stage in *Sorghum* was described by Patel and his associates (1950).

P. R. Mehta (1937, 1939) studied the fruit rot of apples caused by a species of *Rhizopus* and observed that the optimum pH range of the fungus, 4·2 to 5·0, compared with the pH of the green and ripe apples which was found to be 4·2 and 5·2 respectively.

Chowdhury (1949) investigated a rot of male inflorescence and young fruits of *Artocarpus integrifolia* caused by *Rhizopus artocarpi*.

A new disease of chillies caused by *Choanephora cucurbitarum* was described by Dastur (1920 *b*). The characters of this pathogen, *C. cucurbitarum*, causing wet rot of chillies were studied by Sinha (1940 *a*). Sinha (1939 *b*, 1940 *b*) also studied the wet rot of leaves of *Colocasia antiquorum* due to secondary infection by *C. cucurbitarum* and *C. trispora*; he reduced the name *C. trispora* to synonymy with *Blakeslea trispora*.

(*b*) *Diseases caused by Ascomycetes.*—Among Ascomycetes species of Taphrinales cause a few diseases of economic plants. Bulter (1911 *b*; 1918) described the leaf spot of turmeric (*Curcuma longa*) due to *Taphrina maculans*. This disease is often responsible for considerable damage in the turmeric growing areas of Gujarat, Madras, Hyderabad and Orissa (Mundkur, 1949). Butler (1918) also described the disease of *Coriandrum sativum* where galls are formed due to infection by *Protomyces macrosporus*. Peach leaf curl caused by *Taphrina deformans* is of common occurrence in the Kumaon, Kulu and other parts of the sub-Himalayan range. Hafiz (1947) investigated the occurrence of this disease in the hilly tracts of the Punjab.

Aspergilli are reported to cause a number of diseases including soft rot of apples (Dey and Nigam, 1933) and pears (Prasad, 1938), storage rot of onions (Likhite and Desai, 1935; Venkatarayan and Delvi, 1951 *a*), latent infection and rot of mango fruits (Das Gupta and Bhatt, 1946 *b*; Verma and Kamal, 1951), and latent infection of fruits of *Aegle marmelos* (Sharma, 1953 *a*). Soft rot of apple fruit caused by *Penicillium expansum* was studied by Singh (1941 *b*). Saluja (1941 *b*) studied *Penicillia* causing rots of animals and fruits.

Powdery mildew epiphytotics on peas (*Pisum sativum*) due to *Erysiphe polygoni* occur every year during winters in this country. The disease was described in detail by Butler (1918). Uppal, Kamat and Patel (1936) described a new variety of *Oidiopsis taurica* causing powdery mildew of *Dolichos lablab*. Some new hosts of *Oidiopsis taurica* were reported by Kamat and Patel (1948). Powdery mildew of betel vines caused by a new species of *Oidium* was investigated by Uppal and Kamat (1937). Uppal, Kamat and Patel (1946) suggested the dusting of betel vines with sulphur powder to check this disease.

The annual recurrence of powdery mildew, *Erysiphe graminis*, on wheat and barley was investigated by Mehta (1930 *a*, *b*, *c*) who observed that the mode of dissemination and recurrence of cereal powdery mildew was identical with that of cereal rusts.

Butler (1907 *c*) described the powdery mildew of grape vines. Uppal, Cheema and Kamat (1931) investigated the powdery mildew of grape and its control in Bombay. The cleistothecial stage of this pathogen, *Uncinula necator*, though not formed in the plains, is stated to form in abundance in conditions obtaining in Baluchistan (Mundkur, 1949).

Devarajan (1946) investigated the powdery mildew of oranges due to *Oidium* sp. and suggested methods of controlling the disease. A powdery mildew of cotton (*Gossypium barbadense*) caused by *Oidiopsis gossypii* was studied by Raychaudhuri (1949). Bose (1953 *a*) studied the occurrence of powdery mildew of mango due to *Oidium mangiferæ* at altitudes of 2–400 ft. in Kumaon hills. He suggested several fungicides, of which Peronox was found to be most effective in controlling the disease.

The biological and cultural characters of *Capnodium* sp. on cotton were studied by Sawhney (1926, 1927) who concluded that the action of this species of *Capnodium* was not 'purely saprophytic' but parasitic also. The sooty mould disease of Citrus in Kumaon and its control was studied by Bose (1953 *d*) who referred to the fungus as *Microzyphium* sp, the perfect stage *Chætothyrium citri* of which was found associated with two types of flies.

Butler (1906 *a*, 1918) described the black rot of sugarcane caused by *Sphæronema adiposum*; the pathogen was later shown to belong to the genus *Ceratostomella* by Sartoris (1927) who named it as *C. adiposum*. Another species of *Ceratostomella*, *C. paradoxa* (= *Thielaviopsis paradoxa*) was found to infect sugarcane, coconut and pineapple (Ramakrishnan, 1927). Stem-end rot and soft rot of pineapple caused by *C. paradoxa* was studied by P. R. Mehta (1940) and Chowdhury (1945 *d*).

Ajrekar (1926 *b*) made observations on the ergot disease of jowar (*Sorghum vulgare*) caused by *Sphacelia* (the conidial stage of *Claviceps*). Kulkarni (1942) reported that considerable damage was caused by ergot if the crop was late sown. Thirumalachar (1943 *c*) studied the ergot on sugarcane. Later he reported profuse infection of spikelets of *Cynodon dactylon* by a species of *Claviceps* (1944 *a*). Thomas, Ramakrishnan and Srinivasan (1945 *a*, *b*) surveyed the natural occurrence of ergot in South India. In 1950 Marudrajan and his associates studied the problems of ergot production and its improvement.

Species of *Sclerotinia* cause a number of diseases. Stem-end rot of *Hibiscus sabdariffa* caused by *Sclerotinia sclerotiorum* was investigated by Mundkur (1934 *a*) who found that the mycelium of the fungus

was unable to infect the plants, only the ascospores being capable of attacking the tender tissue of the host. He also emphasized the role of sclerotia in the perpetuation of the disease. Stem rot of tobacco caused by *S. sclerotiorum* was studied by Kheswalla (1934). Mehta, Singh and Bose (1946) reported some new hosts of this pathogen. A destructive disease of peach plum, apples and pears caused by *Sclerotinia fructigena* was investigated by Hafiz (1946). Narasimhan (1952) reported a sclerotial disease of *Orobanche cernua.*

(*c*) *Diseases caused by Basidiomycetes :* (i) *Ustilaginales.*—The more common and economically important smut and bunt diseases occurring in this country have been described by Butler (1918) and Mundkur (1949).

Wheat crops all over the country are affected by loose smut caused by *Ustilago tritici.* Loss due to wheat loose smut, according to one estimate, is stated to amount to over Rs. 50,000,000 (Luthra, 1933). A number of studies have been made with reference to control measures against this disease (Mohendra, 1930; Luthra, *loc. cit.*; Luthra and Sattar, 1934 *a, b*; Patel, Dhande and Kulkarni, 1950). The varietal resistance of Indian and other wheats to loose smut was investigated by Mundkur and Pal (1941).

Butler (1908 *b*) recorded the occurrence of two wheat bunts, *Tilletia tritici* and *T. levis* (now referred to as *T. caries* and *T. fœtida* respectively). Mitra (1931 *a*) reported a new bunt of wheat, *Tilletia indica* sp. nov. (transferred to *Neovossia indica* by Mundkur). A comparative study of the three wheat bunts (*T. caries*, *T. fœtida* and *Neovossia indica*) was made by Mitra (1935 *a*). He studied the effect of the 'karnal' bunt (*Neovossia indica*) on wheat (Mitra, 1937 *b, d*). He also studied the mode of transmission of this bunt and reported the occurrence of soil infection (Mitra, 1937 *a, d*). Mundkur (1943 *a, b*), however showed that this disease was not seed- or soil-borne. He also pointed out that unlike most smut and bunt infections, the 'Karnal' bunt of wheat was not a systemic infection. Investigations by Bedi, Sikka and Mundkur (1949) confirmed that this bunt was not seed- or soil-borne.

Mundkur (1934 *c*) reported that *Ustilago kolleri* causing covered smut of oats (*Avena sativa*) appeared to be more prevalent than *U. avenæ* causing loose smut in this country. Oat leaf infection by *U. avenæ* was studied by Mundkur (1935 *d*).

Ramakrishnan and Reddy (1949) showed that infection of *Sorghum* with long smut occurred through young flowers. The work of Vasudeva and Seshadri Iyengar (1950 *b*) confirmed that this disease was air-borne and that infection took place when the flowers were still very young.

Vaheeduddin (1950) recorded the occurrence of two new physiologic races of *Sphacelotheca sorghi* and presented a key for identifying eight physiologic forms of this grain smut of *Sorghum.*

The bunt of rice caused by *Neovossia horrida* is widespread in Assam and was investigated by Chowdhury (1946 *c*, 1951). A six-year survey of the disease made by him showed that it causes only negligible damage since only a very low percentage of the plants are attacked and only a few grains in an ear are usually affected. He also reported that the disease was influenced by the climatic conditions and that the infection occurred through flowers.

Ajrekar and Likhite (1933) reported that in wet years appreciable damage was caused by smut of bajra (*Pennisetum typhoideum*) due to *Tolyposporium penicillariæ*. A comprehensive study of the mode of infection of bajra plant by this smut was made by Bhatt (1944 *a*, 1946). An interesting aspect of this study refers to the path of the infection hypha inside the bajra plant (Bhatt, 1946). Vasudeva and Seshadri Iyengar (1950 *a*) reported the occurrence of secondary infection in the bajra smut disease caused by *Tolyposporium*. He found that the smut spore balls could germinate immediately on the host without undergoing a dormancy period, and caused secondary infection.

A serious smut disease of Job's tears millet (*Coix lachryma jobi*) due to *Ustilago coicis* was described by Chowdhury (1946 *d*) from Khasi Hills, Assam. The transmission of this disease was found to occur through seed-borne spores.

Thirumalachar and Mundkur (1947) investigated the morphology and the mode of transmission of the ragi (*Eleusine coracana*) smut caused by *Melanopsichium eleusinis*.

Mundkur (1943 *c*) reported that sawan (*Echinochloa frumentacea*) was attacked by two smuts, *Ustilago panic-frumentaci* and *U. paradoxa*. The life-history and mode of infection of sawan smut due to *U. paradoxa* was comprehensively studied by Sharma (1953 *b*). Venkatarayan and Delvi (1951 *b*) reported that occurrence of *U. crusgalli* on *Echinochloa colona*.

Butler (1918) described the smut disease of sugrcane caused by *Ustilago sacchari* (transferred to *U. scitaminea* by Sydow in 1924). The mode of infection of sugarcane smut studied by Dastur (1920 *a*). Luthra, Sattar and Sandhu (1938) investigated the life-history and the modes of perpetuation of the sugarcane smut caused by *U. scitaminea*. The occurrence of this disease in Bihar was studied by Rafay and Padmanabhan (1940).

Khanna and Ramanathan (1946) recorded for the first time the occurrence of a *Sphacelotheca* sp. on a species of *Saccharum* by reporting the infection of ' Munj ' grass (*Saccharum munja*) due to *Sphacelotheca schweinfurthiana*. The first record of a *Sphacelotheca* sp. on sugarcane was made by Chona and Munjal (1951) who reported the occurrence of a new smut, *Sphacelotheca cruenta* on sugarcane.

Mitra (1927 *b*, 1928) studied the gall formation in the root of mustard (*Brassica campestris* var. *sarson*) due to a smut *Urocystis*

coralloides. Host range and identity of the smut causing root galls in the genus *Brassica* was investigated by Mundkur (1938 *a, b*) who found it to be different from *U. coralloides* and proposed a new name for it, *brassicæ*.

(ii) *Uredinales*.—Tremendous losses are caused by cereal rust epiphytotics that recur every year in India. Studies on their epidemiology and the methods of their control comprise some of the most important phytopathological researches carried out in this country.

Milligan (1907) reported a heavy outbreak of rust on wheat in Punjab and ascribed the " heavy infection of the rust to the weakening of the plants due to inclement weather ".

A comprehensive investigation of the wheat rust problem in India was carried out by K. C. Mehta and his school of workers. Mehta started his work on the problems of annual recurrence of cereal rust at Cambridge in 1920 and on his return to India he continued this study for the next three decades. Under a scheme financed by the Imperial (now Indian) Council of Agricultural Research, he and his associates collected a large amount of elaborate epidemiological data derived from a phytopathological investigation and aerobiological survey. Some conclusions based on these data have been the subject of controversy among certain sections of phytopathologists in this country. Mehta (1929, 1931 *a, b*, 1937, 1941) showed that *Berberis* and other alternate hosts do not play any significant role in the perpetuation of wheat rusts in India, and that there is no local source of infection for the recurrence of rust in the plains where the intense summer heat destroys all the rust inoculum of the preceding season. He presented evidence to show that the principal source of inoculum responsible for fresh outbreaks of rust epiphytotics in the plains was derived from the rust infection on the summer-grown wheat crop in the hills. He suggested the cessation of wheat cultivation in the hills for a period of five years as a measure to check the recurrence of rust in the plains where the major bulk of the wheat crop is grown.

Prasada contributed a number of interesting studies on the role of alternate hosts of cereal rusts in this country. Prasada (1946) reported that aeciospores of rust found on *Thalictrum* in Simla hills could infect *Agropyron semicostatum* resulting in the production of the uredo-stage of the rust. This rust, however, was found to be unable to infect wheat and barley seedlings. Later, he (1947 *d*) discovered the uredo-stage connected with aecidia commonly found on species of *Berberis* and showed that it was a new specialised form of *P. graminis*, which he described under the name *P. graminis agropyri*. He reported that aeciospores of this rust were unable to infect wheat, barley, oats and rye, though it could infect three species of *Agropyron* leading to the production of its uredo-stage. Prasada (1948 *a*, 1951) investigated the pathogenicity of rusts occurring on wild grasses growing in the neighbourhood of wheat plots in Simla. He reported that cross-inoculations on reciprocal hosts with yellow rust (*P. glumarum*)

occurring on *Phalaris minor* and that on wheat plants were unsuccessful. On the other hand, black rust (*P. graminis*) from some exotic grasses could infect wheat plants and *vice versa*. In the light of these findings, Prasada (1951) suggested that it was very essential to test the reaction of the imported grasses to Indian physiologic races of wheat rusts under quarantine conditions prior to their release for general cultivation in this country, as these may act as collateral or alternate hosts of wheat rusts.

The effect of brown rust infection on the growth, yield and water economy of resistant and susceptible varieties of wheats was studied by Pal (1936 *a*). Ekbote and Kalamkar (1945, 1947) studied the damage to the wheat crop by rust in relation to variety and time of sowing. Studies on physiologic specialisation in *Puccinia graminis tritici* were carried out by Uppal and Gokhale (1947) and Gokhale (1950).

Dastur and Pal (1947) briefly reviewed the problem of wheat rusts and their control. The control of wheat rusts by breeding resistant varieties was discussed by Pal (1948). De Quadros (1952) suggested mixed cropping of wheat and gram as an insurance against wheat rusts. Gattani (1952) reported that spraying plants with hydrophobic colloidal sulphur provided a fairly efficient method of control of wheat rusts.

Ramakrishnan and Soumini carried out a series of studies on cereal rusts including *Puccinia penniseti* occurring on *Pennisetum typhoideum* (Ramakrishnan and Soumini, 1948 *b*), *Uromyces setariæ-italicæ* on *Setaria italica* (Ramakrishnan, 1949) and *Puccinia purpurea* on *Sorghum* (Soumini, 1949).

The linseed rust, *Melampsora lini*, was investigated by Prasada (1940, 1947 *a*, 1948 *c*). He described the life-history of this rust and discussed the problem of its over-summering. Studies on lentil rust, *Uromyces fabæ*, by Prasada and Varma (1948), and on clover rust, *Uromyces trifolii*, by Prasada and Goswami (1950) showed that teleutospores of these rusts remained viable through the summer and caused fresh outbreaks in the following season when the weather conditions were favourable.

The coffee leaf rust, *Hemileia vestatrix*, was first reported from Ceylon in 1868 and within next dozen years the rapidity of its spread and severity of the damage caused by it led to the total abandonment of coffee cultivation in that country. The coffee rust was first recorded in 1870 from India. Mundkur (1949) presents a brief account of the disease and the factors that contributed to the survival of coffee cultivation in this country. A great deal of work on the disease has been carried out by the workers of the Mysore Department of Agriculture and the Planters' Association in Southern India. Studies in physiologic variation in the coffee rust, and the development of resistant varieties of coffee, have been carried out at the Coffee Experiment Station in Mysore. Some observations on varietal resistance to rust of coffee were made by Thomas (1927).

(iii) *Homobasidiomycetes.*—Several species of polypores have been reported to cause diseases of forest trees. Mayes (1905) recorded *Trametes pini* as a wound parasite of *Pinus excelsa*. Butler (1909) reported the occurrence of *Fomes lucidus* as a suspected parasite on *Abies*, *Tsuga* and many other broad-leaved trees. The pathogenicity of *Polyporus gilvus*, a suspected parasite of shisham (*Dalbergia sisso*) was studied by Khan (1923). Sen-Gupta (1932) reported that the action of *Polyporus zonalis* on bamboo was one of delignification and absorption of starch grains from the cells of the host.

Research in forest pathology was initiated by Bagchee at the Forest Research Institute, Dehra Dun. In 1939, Bagchee reviewed the investigation on the various tree diseases and the problems associated with coniferous rusts, root- and stem-rotting fungi, canker pathogens, nursery diseases, timber diseases, and the ecology and habits of forest fungi. He also listed rusts and polypores attacking forest trees. The principal diseases and decays of oaks in India caused by several species of polyporaceous fungi were studied by Bakshi and Bagchee (1950). In 1951 Bagchee and Bakshi described the rot of pine-wood (*Pinus longifolia*) by *Poria monticola*.

Among the agarics, *Schizophyllum commune* was found to grow parasitically on big trees in Lahore by Chaudhuri and Johar (1931 *a*, 1934). Lacy (1950 *b*) reported the occurrence of *Marasmius rotula* as a mild parasite on *Derris sinuata*.

Species of *Pellicularia* and their respective *Rhizoctonia*-stages cause a number of important plant diseases. The morphology and parasitism of Indian species of *Rhizoctonia* was investigated by Shaw (1912) and Shaw and Ajrekar (1915). The life-history of *Corticium koleroga* causing black rot of coffee was studied by Narasimhan (1933 *a*, *c*). Dastur (1941) investigated the pink disease of orange trees due to *Corticium salmonicolor* in Central India and suggested control measures. Singh (1943 *a*) studied the pink disease of apples due to *C. salmonicolor* in Kumaon.

(*d*) *Diseases caused by Deuteromycetes.*—Large number of plant diseases in India, many of which are of considerable economic importance, are caused by deuteromycete pathogens. Lack of space makes it imperative for this review to mention in passing the work on no more than a few diseases of some economic plants only. Diseases of a very few ornamental and fruit trees are also included.

Leaf-spot disease of wheat due to *Helminthosporium triticirepentis* was studied by M. Mitra (1934 *a*). Padwick (1940 *c*) investigated the foot rot of wheat caused by *Fusarium* species. The black point disease of wheat caused by *Alternaria tenuis* was reported by Tandon (1946) and Tandon, Das and Srivastava (1953).

Leaf-spot of rice caused by *Helminthosporium oryzæ*, which is of common occurrence in India, was studied by Sundararaman (1922)

and Singh (1934 *a*). The nature and extent of damage caused by this disease was investigated by Padmanabhan, Roy Choudhry and Ganguly (1948), while Chattopadhyay (1952 *c*) made trials for its control. Among other diseases of rice, mention may be made of the 'Stackburn' of rice caused by *Trichoconis padwickii* (Padwick and Ganguly, 1945; Padmanabhan, 1949) and seedling blight of rice caused by *Curvularia lunata* and *Helminthosporium* spp. (Hingorani and Prasad, 1951; Salam and Rao, 1953).

The sclerotial disease of rice caused by *Sclerotium oryzæ* (= *Leptosphæria salvinii*) was studied by Shaw (1913 *b*), Pushkar Nath (1933 *b*), Mundkur (1935 *a*, *b*), Hidayatullah and Raychaudhuri (1941) and by Paracer and Luthra (1944).

A common wilt disease of pigeon pea (*Cajanus cajan*) in India is caused by *Fusarium udum* (Butler, 1906 *b*, 1918; Mohanty, 1946). Sarojini (1951) reported that in the field survival and persistence of Fusarium udum was related to the presence of certain micronutrients in the soil. Kalyanasundaram (1952) reported that there was a considerable reduction of ascorbic acid content in plants affected by *F. udum*. The effect of associated microflora on the pathogenicity of *F. udum* was studied by Vasudeva and Govindaswamy (1953).

The blight of gram caused by *Ascochyta rabiei* (= *Mycosphærella rabiei*) was investigated by Butler (1918), Luthra and Bedi (1932), and Luthra, Sattar and Bedi (1935). Luthra, Sattar and Bedi (1943) suggested methods of controlling the disease.

Red rot caused by *Colletotrichum falcatum* (= *Physalospora tucumanensis*) is a serious disease of sugarcane. It was studied by Butler and Khan (1913 *a*) at Pusa. Luthra and Singh (1932 *b*) and Rafay and Padmanabhan (1947) studied the cultural variation in this pathogen. A series of detailed studies on red rot of sugarcane have been carried out by Chona (1943 *a*, 1947, 1950) with reference to the mode and sources of infection, varietal resistance and control measures.

Among the other diseases of sugarcane mention may be made of wilt caused by *Cephalosporium sacchari*, collar rot caused by *Hendersonia sacchari*, and Helminthosporiose caused by *Helminthosporium sacchari* (Butler and Khan, 1913 *b*), stem canker caused by *Cytospora sacchari* (Luthra and Singh, 1938) and top rot caused by *Fusarium moniliforme* (Ramakrishnan, 1941 *b* and Rafay, 1952).

An important root rot disease of cotton due to *Rhizoctonia solani* and *R. bataticola* was investigated by a number of workers including Likhite (1932 *b*, 1935 *a*), Likhite and Kulkarni (1934). Vasudeva and his associates (1935–45) carried out a series of comprehensive studies on this disease with reference to its symptomatology, incidence and etiology (Vasudeva, 1935 *b*), the physiology of the causal fungi (Vasudeva, 1936), the effect of mixed cropping on the incidence of the disease (Luthra and Vasudeva, 1940; Vasudeva, 1941), and the effect of certain

fungi on the growth of cotton root rot fungi (Vasudeva and Sikka, 1941). Vasudeva (1943; 1945) made attempts to control the disease by varying the sowing date, and by fumigation and various cultural treatments of the soil. Studies on cotton root rot in Sind were carried out by Prasad (1944).

Another important disease of cotton (which is confined to the black cotton soils of Southern India) is cotton wilt. There has been a certain amount of controversy with reference to the cause of this disease. Kottur (1924) reported that the wilt of cotton was caused by a species of *Fusarium* which was identified as *F. vasinfectum* by Elliot (1924). Dastur (1924, 1931), on the other hand, stated that the accumulation of aluminium and iron compounds in the vessels of cotton plants was the primary cause of this disease and regarded *F. vasinfectum* as only a secondary factor. Butler (1926), Ajrekar (1926 *a*), Kulkarni (1931, 1934) and Kulkarni and Mundkur (1925, 1931 *a, b*) confirmed the pathogenicity of *F. vasinfectum* in cotton wilt under certain unelucidated conditions, which, according to them, were probably not related to soil composition as suggested by Dastur. Satyanarayana and Kalyanasundaram (1952) studied the varietal susceptibility of cotton plants to wilt disease. Kalyanasundaram (1952) investigated the change in ascorbic acid content of wilted cotton plants. Variation in *F. vasinfectum* was recorded by Subramanian (1952 *f*).

The stem rot of jute caused by *Macrophoma corchori* (= *Macrophomina phaseoli*) was investigated by Shaw (1924). Rajan and Patel (1946) established the seed transmission of this pathogen and studied the effect of the disease on the quality and output of jute. Chattopadhyay and his associates (1952) made observations on the incidence and control of this disease.

Of the diseases of potato, early blight caused by *Alternaria solani* is common in India. It was investigated by Butler (1918) and Bhagwagar (1946). The fungicidal control of this disease was studied by Vasudeva and Azad (1952) and Chattopadhyay (1952 *b*). Another important disease of potato is tuber rot by *Fusarium* sp. (Ajrekar and Kamat, 1923; Chona, 1933 *a*; and Sattar and Hafiz, 1943). Agarwala (1949) investigated the mode of infection of potatoes by *F. oxysporum*. The charcoal rot of potatoes due to *Macrophomina phaseoli* was studied by Thirumalachar (1952).

The 'Tikka disease' of groundnuts (*Arachis hypogea*) caused by *Cercospora personata* (= *Septogloeum arachidis*) was investigated by Butler (1914 *a*, 1918). Mundkur (1949) reported that leaf-spots in *Arachis hypogea* were also caused by another species, *Cercospora arachinidicola* which produced symptoms distinct from those caused by *C. personata*. Among the other diseases of oil-yielding plants, mention may be made of blight of linseed (*Linum usitatissimum*) caused by *Alternaria lini* (Dey, 1933), blight of 'Til' (*Sesamum orientale*) caused by *Cercospora sesami* (Chowdhury, 1945 *e*) and leaf-spot disease of

castor oil plant (*Ricinus communis*) caused by *Phyllosticta bosensis* (Bose and Mathur, 1949).

The root rot of *Piper betle* caused by *Rhizoctonia solani* was investigated by McRae (1934) and Chowdhury (1944 *b, c*). Chowdhury (1945 *a*, 1946 *f*, 1948 *c*) studied the effect of soil conditions on the sclerotial wilt of *Piper betle* caused by *Sclerotium rolfsii* (= *Corticium rolfsii*).

Deuteromycete diseases of tea (*Thea sinensis*) reported from India include the grey blight caused by *Pestalozzia theæ* (Butler, 1918; Sen, 1926; Kapur, 1932 *a*; Bhatia, 1933), internal root disease caused by *Thyridaria tarda* (= *Botryodiplodia theobromæ*) (Butler, 1918; Anand, 1934 *b*) and a root disease from Central Travancore caused by *Cylindrocladium* sp. (Venkataramani, 1952).

Colletotrichum glœosporioides (= *Glomerella cingulata*) has been found to cause a number of diseases including stem-end rot and wither tip disease of Citrus (Chaudhuri, 1936 *b*; Chaudhuri and Singh, 1930; Chaudhuri and Johar, 1931 *b*; Asthana, 1946), anthracnose of mango (Sattar, 1939; Sattar and Malik, 1939), and fruit rot of *Anona reticulata* Chowdhuri, 1947 *b*). *Glomerella psidii* associated with guava canker was studied by Venkatakrishnaiah (1952).

Among the diseases of trees, mention may be made of wilt of *Casuarina* caused by *Trichosporium vesiculosum* (Marudarajan, Ramakrishnan and Soumini, 1950), wilt of *Acacia melanoxylon* caused by *Fusarium cœruleum* (Verma, 1951) and die-back of *Polyalthia longifolia* associated with *Phomopsis* and other fungi (Das Gupta and Kamal, 1953). Das Gupta and Zachariah (1939, 1945) studied the die-back of mango tree associated with *Botryodiplodia theobromæ*, *Phoma* sp. and *Fusarium* sp. Wilt disease of guava due to a species of *Fusarium* was investigated by Das Gupta and Rai (unpublished). Prasad, Mehta and Lal (1952) identified the guava wilt pathogen as *Fusarium oxysporum* f. *psidi*. The biology of *Pestalozzia palmivorum* causing brown spots on leaves of coconut palms was studied by Agarwala and Baruah (1953).

Bacterial Diseases of Plants

Bacterial diseases of plants have received relatively little attention in India. The Plant Pathological Laboratory of the College of Agriculture, Poona, has been the principal centre of research on plant disease bacteria under the leadership of M. K. Patel and his associates. A brief review of the bacterial plant disease investigation in India was recently made by Patel and Kulkarni (1953).

The first record of a bacterial plant disease from this country was made by Butler (1903 *a*) who reported the 'bangle blight' of potatoes caused by *Phytobacterium solanacearum*. This disease, also known as the 'ring disease' of potato, is of common occurrence and has been

recorded by Coleman (1909), Mann and Nagpurkar (1921) and Patel, Kulkarni and Kulkarni (1952) reported that the problem of potato ring disease in the Bombay State was practically solved by planting disease-free potato seeds from Simla Hills.

The factors affecting soft rot of potatoes caused by four species of bacteria during transit and storage were studied by Hingorani and Addy (1953).

Hutchinson (1913) studied a bacterial wilt of tobacco in Rangpur District in Bengal and identified the pathogen as *Phytobacterium solanacearum.*

" Tondu " disease of wheat ears is common in some parts of the Punjab and was studied by Hutchinson (1917) and Chaudhuri (1935 *a*). Patel and Kulkarni (1953) pointed out that the pathogen *Aplanobacter tritici* (Hutchinson) Burkholder reported to cause this disease " appears to be a doubtful species of the genus *Aplanobacter* as it has never been proved pathogenic by itself ".

A bacterial disease of cotton, commonly known as " angular leaf-spot " or " black-arm " of cotton, has been the subject of several studies. Ballard and Norris (1923) reported that the angular leaf-spot of cotton caused by *Xanthomonas malvacearum* (Smith) Dowson, was prevalent in parts of Madras State. Balasubrahmanyan and Raghavan (1949) reported that in Madras it was confined to regions where eco-climate was normally congenial for its incidence. The influence of rainfall on the incidence of the disease and the disease resistance of different cotton varieties was studied by Ramakrishnan and Ramakrishnan (1950 *d*). Nitrogen utilisation by *Xanthomonas malvacearum* was studied by Patel and Kulkarni (1949).

Uppal (1948), in his monograph on cotton diseases, stated that the angular leaf-spot of cotton was a disease of minor importance in this country, probably because of the resistance to this disease shown by most indigenous cottons (belonging mainly to two species, *Gossypium arboreum* and *G. herbaceum*). Patel and Kulkarni (1948, 1950) found exotic types of cotton (mainly belonging to *G. hirsutum*) to be susceptible to this disease. Some varieties of *G. arboreum* and *G. herbaceum* were also found to be susceptible (Patel and Kulkarni, 1950; Balasubrahmanyan and Kesava Iyengar, 1952). Kulkarni and Patel (1951) reported some preliminary observations on the inheritance of the black-arm resistance in strains of *G. herbaceum.*

Two radically opposite views are held regarding the original home of the black-arm disease of cotton. Knight (1948), and Knight and Hutchinson (1950) consider it to be originally a disease of ' Old World ' cottons of Indian origin and that it was introduced into the U.S.A. Studies on this disease in India, however, tend to indicate that the disease was probably introduced in this country through foreign cotton seeds (Patel and Kulkarni, 1950, 1953).

Ayyar (1927) reported a bacterial soft rot of garden poppies (*Papaver somniferum* and *P. rhœas*) caused by *Pectobacterium aroideæ* (Townsend) Waldee [= *Erwinia papaveris* (Ayyar) Magrou].

Black rot of cabbage due to *Xanthomonas campestris* (Pammel) Dowson was first recorded from this country by Patwardhan (1928). Patel, Abhyankar and Kulkarni (1949) investigated control measures against this disease. Working at the Iowa State College, U.S.A., Bhide (1949 *a*) studied the mode of infection of the cabbage black rot pathogen, *X. campestris*. Normally this pathogen infects the host through hydathodes situated on the leaf margins at the termination of the veins. Bhide's results indicate that stomatal infection is also possible in the black rot of cabbage, but the pathogen is unable to establish itself in this manner as it cannot reach the vascular elements in the leaves. In an earlier paper, Bhide (1948) presented the results of a comparative study of growth response and parasitism of wilt-producing phytopathogenic bacteria.

The specimens of citrus collected at Debra Dun between 1827 and 1831 and deposited at the Kew Herbarium have been found to show citrus canker due to *Xanthomonas citri*. This disease is now well established in citrus orchards all over the country. Pruning followed by spraying with Bordeaux Mixture and a suitable insecticide has proved a promising control measure (Patel and Kulkarni, 1953).

Patel and Padhye (1948) studied a soft rot of mango (*Mangifera indica* L.) caused by a bacterium tentatively referred to as *Bact. carotovorus*. Another disease of mango, the bacterial leaf-spot, was studied by Patel, Kulkarni and Moniz (1948) who described the pathogen as a new species, *Pseudomonas mangiferæ-indicæ*. In the herbarium at Dehra Dun, lesions similar to these have been observed in herbarium specimens of mango leaves collected from Bihar in 1881 and from Kheri and Dehra Dun in 1908.

Among the other bacterial diseases of plants reported from India, mention may be made of leaf-spot of *Piper betle* (Raghunathan, 1928; Asthana and Mahmud, 1944 *a*), soft rot of maize (Prasad, 1930), leaf-spot of khira, *Cucumis sativus* (Prasad, 1931 *a*), white soft rot of turnip (Prasad, 1931 *b*), tomato soft rot (Madhok and Fazal-ud-Din, 1943), tomato canker (Jain, 1951), soft rot of onions in storage (Hingorani and Malla, 1951), soft rot of peas (Hingorani, 1951 *c*), blight of *Phaseolus vulgaris* var. white kidney (Uppal, Patel and Nikam, 1946), leaf-spot and stem canker of pigeon pea (Kulkarni, Patel and Abhyankar, 1950), leaf-spot of soyabean (Uppal, Patel and Kamat, 1938 *b*), leaf-spot of *Desmodium gangeticum* (Patel and Moniz, 1948 *a*, *b*) and *D. diffusum* (Patel, 1949 *c*), leaf-spot of lucerne, chillies, *Xanthium* and castor (Patel, Kulkarni and Dhande, 1949 *b*, 1950 *a*, *b*, 1951 *a*), leaf-spot of *Vitis woodrowii* (Patel and Kulkarni, 1951 *b*) and fire blight of *Cosmos* (Prasad, 1952).

An important contribution to systematic bacteriology was made by Patel and Kulkarni (1951 *a*) in a paper on the 'nomenclature of

bacterial plant pathogens'. They discussed the need for grouping phytopathogenic bacteria under a separate family for which the name 'Phytobacteriaceæ' was proposed by them. The family Phytobacteriaceæ created by them comprises seven genera (including one new genus) primarily based on the types of symptoms produced. They proposed the name *Chlorobacter* nov. gen. for leaf-spot producing, green fluorescent bacteria, and emended the genus *Aplanobacter* to include gram-positive, non-motile, wilt-producing organisms. The genus *Erwinia* was retained for peritrichous plant pathogens not attacking pectin. Patel and Kulkarni (1951 *a*) also presented two keys (detailed and simple) of Phytobacteriaceæ and list some new combinations suggested by them.

Virus Diseases of Plants

Plant viruses recorded from India so far seem to represent only a small proportion of the total number of plant viruses that await investigation. During recent years there has been a growing awareness of the need for a more adequate survey of virus diseases of plants in this country. Researches on plant virus diseases during the last fifty years are briefly outlined below:

Spike disease of sandal (*Santalum album*).—Spike disease of sandal (*Santalum album*) was first reported by Butler (1903 *b*) and later by Coleman in 1917. It causes serious damage to sandal cultivators in South India and has been investigated chiefly by the workers of the Indian Institute of Science, Bangalore, and the Mysore State Department of Agriculture.

For some time the real cause of the spike disease of sandal was held in doubt, but the virus nature of the disease, first demonstrated by Coleman (1917), has now been confirmed by a large number of workers. Coleman (1917, 1923) demonstrated that the disease was transmissible through grafts. The fact that the roots of sandal plants formed haustorial conjunctions with roots of other plants suggested the possibility of root transmission of the disease. These findings were confirmed by the work of Sreenivasaya and Naidu (1928) and Venkata Rao and Iyengar (1934 *b*). It was, however, considered improbable that the transmission of the disease in the field conditions occurred only through haustoria, and a search was therefore made for suspected insect vectors, identity of which is, however, so far unestablished. Rangaswami and Sreenivasaya (1935), Rangaswami and Griffith (1940), and Sreenivasaya and Rangaswami (1934) made observations on natural dissemination of spike disease with reference to the possibility of seed transmission of the disease and the role of *Lantana* in relation to spike disease. The role of undergrowth in the spread of spike disease was studied by Venkata Rao (1935). Muniyappa, Subramaniam and Sreenivasaya (1941) reported that spike disease of *Vinca alba* was transmissible to *Santalum album* and recommended the eradication of this host. Among other studies on control of spike disease of sandal, mention may be made of the work of Iyengar (1933 *b*,

1938 *b*), Iyengar and Rangaswami (1935), Rangaswami and Griffith (1939 *a*, *b*).

Narasimhan (1928 *b*, 1933 *b*) reported the occurrence of intra-cellular bodies in spike disease of sandal, similar to those found associated with other virus diseases.

Jivana Rao (1921 *a*, *b*) investigated the physiological anatomy of spiked leaf in sandal and regarded the spike disease to be due to insufficiency of water owing to relations with unfavourable hosts. The virus nature of the disease was disputed by Jivana Rao (1925) who claimed to have demonstrated experimentally that the spike condition was attained by a process of starch accumulation in the sandal.

Chemical studies on spike disease of sandal were carried out by Iyengar (1928, 1929). Narasimhamoorthy and Sreenivasaya (1929) investigated the nitrogen metabolism in healthy and spiked leaves of sandal. A comparative study of the diastatic activity of spiked and healthy leaves of sandal was made by Sreenivasaya and Sastri (1928, 1929). Sastri (1929) reported that the abnormal accumulation of starch in the spiked leaves of sandal was due to defective translocation of the carbohydrate, possibly due to insufficient proportion of the liquefying fraction. Nitrogen metabolism in healthy and spiked leaves of sandal was studied by Narasimhamoorthy and Sreenivasaya (*loc. cit.*). Sreenivasaya (1930 *b*) reported the occurrence of mannitol in spike disease of sandal. A paper on the physiology of the spike disease of sandal was contributed by Sastri (1936).

Mosaic disease of sugarcane (*Saccharum officinarum*).—The mosaic disease of sugarcane was first reported by Dastur (1923) from the Imperial Institute of Agricultural Research, Pusa. Studies by Dastur (1923, 1932), Luthra and Sattar (1935) and Rafay (1935) showed that mottling of the leaves with yellow spots or streaks was the only characteristic symptom of the disease which was transmissible by injection of infectious juice to healthy plants. The physical properties of the sugarcane mosaic virus were studied by Rafay (*loc. cit*).

McRae and Subramaniam (1933) and Luthra and Sattar (*loc. cit.*) reported that no significant decrease in the yield of cane or juice occurred in the case of plants suffering from mosaic.

Desai (1935 *a*) studied the relationship of the organisms found associated with sugarcane mosaic to the mosaic virus and suggested that the mosaic virus was a stable cyclostage of a bacterium which had a very unstable existence in the bacterial stage.

Dutt, Hussainy and Krishnaswami (1936) working at the Imperial Sugarcane Breeding Station, Coimbatore, investigated varietal resistance to the sugarcane mosaic and observed that varieties containing *Saccharum spontaneum* blood were generally resistant or at least

tolerant. A leaf adaptation conducive to mosaic resistance in sugarcane was recorded by Venkataraman and Thomas (1928).

Chona (1944) investigated the susceptibility of different varieties of sugarcane to mosaic disease. Co. 214 was the only Indian variety which could not be infected artificially. He also suggested use of disease-free stock and roguing as control measures.

A comprehensive five-year study of the mosaic disease of sugarcane at Pusa by Chona and Rafay (1950 *a*) showed that all setts from mosaic infected plants did not produce diseased plants; that amount of recovery from mosaic varied greatly with different varieties, place and year; that little or no natural dissemination occurred in India. Insect vector of the disease is as yet undetermined in India and it is suggested that it could be one other than *Aphis maidis*, the universally recognised vector of sugarcane mosaic.

Diseases of potato (*Solanum tuberosum*).—Virus diseases of potatoes were reported from the Punjab by Mahendra (1930) and later described by Pal (1943). Vasudeva and Lal (1944 *b*) isolated potato virus 'X' (*Solanum* virus 1) from majestic potatoes and worked out the physical properties of the virus. They also isolated potato virus 'Y' from Phulwa potatoes affected with severe mosaic and studied its physical properties.

Vasudeva (1946) studied the masking of symptoms and yield in relation to mosaic. The mosaic types observed on plants of Phulwa variety of potatoes were: negligible mottle; mild mosaic; borderline mild mosaic; severe mosaic and borderline severe mosaic. Potato virus A (*Solanum* virus 3) was isolated from Phulwa and Darjeeling Red Round Potatoes by Vasudeva and Ramamoorthi (1946). The visible symptoms were yellowing of leaf margins or brilliant yellow mottle and leaf crinkling.

Foliar necrosis of Phulwa potato was studied by Vasudeva and Gupta (1947). Mottling of leaves with necrotic spots were the prominent symptoms. The disease was sap transmissible to other solanaceous plants.

Vasudeva and Azad (1948) reported necrosis of Darjeeling Red Round potatoes in which dwarfing of plants and leaf curl was noticed. The disease was found transmissible through grafts and through white flies (*Bemisia tabaci*).

Pushkar Nath (1949) observed that leaf-roll virus was the most common cause of seed degeneration. Out of a total of 24 varieties tested 16 were susceptible to virus 'X', in 19 varieties, virus 'Y' was found in many combinations of virus 'X', and only one was found to be resistant.

Attempts to obtain virus-free seed-potatoes were made by Vasudeva and Azad (1949, 1952). Studies on the movement of tobacco mosaic

virus and potato virus 'X' through tomato plants were made by Capoor (1949 *a*) at Rothamsted Experimental Station and by Capoor and Varma (1949) at Poona.

Khanna and Ganguly (1953) at the Potato Breeding Station, Simla, estimated a loss of 77·5 per cent. to 87·5 per cent. in the Craig's Defiance potato variety due to virus 'Y'. Raychaudhuri (1953 *b*) studied the dilution curve of a ring spot strain of potato virus X.

Diseases of tomato (*Lycopersicon esculentum*).—Virus diseases of tomato were recorded by Likhite (1930). Desai (1933 *a*, *b*) investigated the nature of the causative agent of the mosaic disease of tomatoes. A bacteriophage was obtained from the diseased tissue which was tested for its lytic action on a number of soil organisms. The occurrence invariably of these organisms in diseased tissues and their absence from the healthy tissues led him to believe that these were in some way connected with the disease production in tomatoes.

Big-bud disease of tomatoes showing floral abnormalities, virescence and overgrowth was recorded by Vasudeva and Lal (1944 *a*) from Delhi. The disease was graft transmissible. Vasudeva and Samraj (1947) observed a latent virus in Sutton's Early Market tomato. They noticed that following the disappearance of early symptoms, the plants later presented a healthy look. X-bodies were found to be present and extracts from diseased plants produced symptoms on other members of the *Solanaceæ*. In 1948, Vasudeva and Samraj described a leaf curl disease of tomato affected with dwarfing, puckering of leaves and its excessive curling. The disease was graft transmissible. Transmission through white fly (*B. tabaci*) of the disease to tobacco indicated it to be tobacco leaf curl virus.

Vasudeva, Garg and Azad (1949) studied a necrosis in tomatoes. Crinkling and mottling of leaves with necrotic spots were the symptoms recorded. The disease was sap transmissible to a number of plants belonging to *Solanaceæ*.

Raychaudhuri (1952 *c*) studied the internal browning of tomato working at the Rockefeller Institute in New York. Das and Raychaudhuri (1953) at Delhi studied a probable strain of tomato aucuba mosaic. Leaves showed interveinal mottling and yellowing. The causal virus, which was sap transmissible, appeared to be a strain of tomato aucuba mosaic virus.

Diseases of the tobacco (*Nicotiana* spp.).—Movement of tobacco mosaic virus in the leaves of *Nicotiana sylvestris* was studied by Uppal (1934 *c*).

The most important disease of tobacco is the leaf curl. Five types of leaf curl of tobacco were observed and recorded by Pal (1937) and Pal and Tandon (1937) at New Delhi. Four out of the five types were regarded as distinct viruses and fifth a mixture of the two. Tobacco

leaf curl was found to be graft transmissible. Entomological investigations carried out by Pruthi and Samuel (1937, 1939, 1941, 1942) demonstrated transmission through white fly (*Bemisia tabaci*) on tobacco, tomato, sannhemp, *Ageratum conyzoides* and *Zinnia elegans*.

Pruthi (1944) calculated an economic loss of about 60–70 per cent. caused by leaf curl of tobacco, and designated the leaf curl viruses as A, B, C, D and X according to the five types of visible symptoms they produce. He reported that spraying and dusting, with effective chemicals, the crop at ten-day intervals for two months reduced the spread of the disease to a large extent.

Moorthy, Desai and Samuel (1948) made a preliminary study of chemical and physico-chemical control of tobacco leaf curl. They observed that manurial treatments greatly influenced the resistance of tobacco plants to the leaf curl infection, and reported that while nitrogenous manures increased the susceptibility of the host to disease, phosphates increased resistance.

Garg (1949) reported that white flies when transferred from diseased *Schizanthus* to tobacco produced typical leaf curl symptoms on the latter.

Raychaudhuri (1952 *b*), at Rockefeller Institute in New York, studied the retention of tobacco mosaic virus in tomato seeds. Seeds obtained from tomatoes showing internal browning were germinated and extracts from these plants were seen to produce lesions on *Nicotiana* plants indicating the presence of tobacco mosaic virus. The seeds of tomato were observed to retain the virus for fourteen to twenty-seven days.

Diseases of brinjal (egg plant) (Solanum melongena).—Little leaf disease of brinjal was reported by Thomas and Krishnaswami (1939) from the Agricultural Research Institute, Coimbatore. The disease was graft transmissible to *Datura fastousa*, tomato, tobacco, wild brinjal *Solanum xanthocarpum* and *S. trilobatum*. Two species of jassids, *Euetettix phycites* and *Empoasca devastans*, were reported to be the vectors.

Raychaudhuri (1947 *b*) described a mosaic disease of brinjals from Delhi. The symptoms included bright green mottling, puckering and crinkling of leaves with occasional rings. The disease was transmissible through graft and through *Empoasca devastans*. The symptoms of this disease were found to differ from those described from Rumania.

Cucumber mosaic virus.—Vasudeva and Lal (1943) described mosaic disease of bottlegourd (*Lagenaria vulgaris*) and designated the virus as Cucumis virus 3. Capoor and Varma (1948 *e*) described another mosaic disease, virus of which was referred to as Cucumis virus 2 B.

Vasudeva and Nariani (1952) at Delhi studied the host range of bottlegourd mosaic virus and showed that leaf extracts of *Datura*

stramonium and *Chilli* at a dilution of 1 in 100 and *Solanum nigrum* and tomato at 1 in 1000 inactivated the virus.

Vasudeva and Pavgi (1945) studied the seed transmission of melon mosaic virus. They isolated a strain of cucumber mosaic virus from the infected stock.

Vasudeva, Raychaudhuri and Singh (1949) isolated at New Delhi a new strain of Cucumis virus 2 from *Lagenaria leucantha* (= *L. Siceraria*). Raychaudhuri, Lal and Vasudeva (1951) made further studies on Cucumis virus 2 C (a strain of cucumber green mottle mosaic) isolated from *L. leucantha* (= *L. siceraria*).

Bhargava (1951 *b*), working at the Rothamsted Experimental Station, made a comparative study of four strains of cucumber mosaic virus with reference to their host range, symptom production, virulence, aphid transmissibility and physical properties.

Diseases of Bean (*Phaseolus* spp./*Dolichos lablab*).—Capoor and Varma (1948 *c*) from Poona reported the occurrence of yellow mosaic of *Phaseolus lunatus*, enation mosaic of *Dolichos lablab* and a new virus disease (Double-bean yellow mosaic) of *D. lablab*.

Ali (1950), working at the Wisconsin University, studied the genetics of resistance to the common bean mosaic virus (Bean virus 1) in *Phaseolus vulgaris*. Crosses were made between susceptible and resistant varieties and inheritance of resistance was studied.

Bawden, Chaudhuri and Kassanis (1951) described some properties of broad-bean mottle virus which was seed transmissible and yielded a specific nucleo-protein containing nucleic acid of the ribose type.

Diseases of cowpea (*Vigna catiang*) *and pigeon pea* (*Cajanus cajan*).—Vasudeva (1942) recorded a mosaic disease on cowpea. Capoor, Varma and Uppal (1947) from Poona reported the mosaic disease of *Vigna catjang*. The leaves were malformed, dwarfed and chlorotic in the affected plants, which bore few seeds.

Capoor (1950 *b, d*) from Poona studied the symptomatology and modes of transmission and host range of sterility disease of pigeon pea. It was designated as " Pigeon pea sterility mosaic virus ".

Diseases of cotton.—An abnormality of the Punjab American Cottons was reported by Afzal (1933 *a, b*) and Afzal, Jaggi and Singh (1935). Small leaf disease of cotton was reported by Gokhale (1936) and Uppal, Capoor and Raychaudhuri (1944).

Yellow vein-mosaic of bhendi (*Hibiscus esculentum*).—The yellow vein mosaic of Bhendi was reported by Uppal, Varma, and Capoor (1940). Detailed studies extending over a period of several years,

carried out by Capoor and Varma (1950 *b*), Varma, Capoor and Patel (1950) and Varma (1952), revealed that the virus was not sap transmissible. Transmission was possible only through grafting and the white flies (*Bemisia tabaci*). The virus was, however, not carried through the eggs of the viruliferous flies. They suggested a number of control measures against the disease.

Diseases of Crotalaria *spp.*—Mosaic disease of sannhemp (*Crotalaria juncea*), smalling and leaf curl were recorded by Raychaudhuri (1947 *a*, 1948) and Capoor (1950 *a*). Mosaic and smalling were found to be sap transmissible while leaf curl was graft transmissible. Foliar stunting, malformation and leaf puckering with occasional thin enations were the chief symptoms of the mosaic of sannhemp observed by Capoor in Bombay.

Raychaudhuri and Pathanian (1950) reported a mosaic disease of *Crotalaria mucronata*. The virus was sap transmissible to its own host *Crotalaria juncea*, cowpea, *Phaseolus* spp. The virus was not seed-borne.

Electron microscopic studies of sann-hemp mosaic virus were carried out by Das Gupta, De and Raychaudhuri (1951) at the Institute of Nuclear Physics, Calcutta. Crystalline preparations on examination revealed the presence of spherical particles of diameter between 26 to 40 mμ. Electron microscopic determination of size and shape of a new mosaic disease of sannhemp was made by De (1951).

Diseases of Papaw (*Carica papaya*).—Sen, Ganguli and Mallick (1946) working at the Horticulture Research Station, Sabour, reported a serious disease of papaya trees resulting in foliar etiolation, leaf curl and premature death of fruits. Although sap transmission produced symptoms in healthy trees, it was observed that the diseased condition could also be induced by water-logging of the soil.

Capoor and Varma (1948 *d*) described a mosaic disease of *Carica papaya* in Bombay Province. The disease was transmissible by mechanical inoculations. The virus was observed to be very unstable and of non-persistent type. The disease was not seed transmissible.

Miscellaneous diseases.—Kulkarni (1924) referred to the occurrence of many obscure diseases of crops such as cardamom, chilli, etc., and suggested that attention should be paid to a study of such obscure diseases before they really become important for study.

Among other virus diseases investigated in India, mention may be made of mosaic disease of chillies in Bombay (Uppal, 1928), spike diseases of *Vinca rosea* (Iyengar, 1933 *a*), spike disease of *Dodonea viscosa* (Sastri and Narayana, 1931), leaf curl of *Zinnia elegans* (Mathur, 1933), phyllody of *Sesamum* at Pusa (Pal and Pushkar Nath, 1935), phyllody of sannhemp (Bose and Misra, 1938), bunchy top of plantains

(Varghese, 1945), mosaic disease of cardamom in South India (Uppal, Varma and Capoor, 1945), mosaic disease of Ragi at Mysore (Venkatarayan, 1946 *a*), mosaic disease of *Malvastrum coramandelianum* (Venkatarayan, 1947), mosaic disease of *Datura alba* (Capoor and Varma, 1948 *b*; Capoor, 1950 *c*), distortion mosaic of *Datura inoxia* (Capoor and Varma, 1952), yellow mosaic of lettuce (Vasudeva, Raychaudhuri and Pathanian, 1948), *Solanum jasminoides* virus (Pushkar Nath, 1952), Bayberry yellow (Raychaudhuri, 1952 *a*, 1953 *a*), *Saponaria* leaf curl (Azad, 1953), virus disease of *Thevetia neriifolia* (Garg, 1953) and *Physalis peruviana*, a new host of tobacco leaf curl virus (Nariani and Pathanian, 1953). Mosaic disease of chilli was transmitted by *Aphis gossypii* at New Delhi by Raychaudhuri and Jha (1954).

Physiological studies on viruses.—Desai (1933 *b*) at Pusa studied the nature of the causative agent of the virus diseases of plants. Sadasivan (1940), working at Rothamsted Experimental Station, carried out a quantitative study of the interaction of viruses in the plants. He demonstrated that when the saps of healthy plants were mixed with potato virus 'X' or Aucuba mosaic virus *in vitro*, there was an inhibition in the lesion production on *Nicotiana tabacum* and *N. sylvestris*. Saps containing strains of unrelated viruses also reduced the infectivity to the same extent as healthy saps. However, saps containing strains of related viruses, had greater and specific inhibitory action.

Uppal and Capoor (1940) discussed the movement and mechanism of movement of the viruses within their hosts.

Studies on the production of plant virus inhibitors by fungi and mechanism of inhibition of plant virus infection by fungal growth products were made by Gupta and Price (1950, 1952), at the University of Pittsburg, Pennsylvania. Detailed studies were made with filtrates of *Neurospora sitophila* and *Trichothecium roseum* and it was found that the inhibitors acted on the host and not on the virus.

General Studies.—Origin and development of the views on virus diseases were discussed by Roy (1951 *a*).

Capoor (1952) devised a culture box for practical purposes of collection, preservation and transportation of virus affected plant material.

Physiological Diseases of Plants

Among the physiological diseases of plants, mango necrosis has received considerable attention in India. It is also known as the 'black-tip' or 'kœli' disease of mango and is characterised by the necrosis of tissues at the tip of the fruits. It is of common occurrence in mango orchards situated in the vicinity of brick-kilns in Uttar Pradesh, Bihar, and parts of Bengal and the Punjab. It has been comprehensively studied by Das Gupta and his school of workers at Lucknow in Uttar Pradesh and by Sen in Bihar.

Mango necrosis was first recorded from Bihar in 1909 by Woodhouse and later from Uttar Pradesh by Dey. Reference to this disease was also made by Naik (1934), by Allan (1936) and by Pal, Chatterji and Ranjan (1937). The first detailed observations on the disease were made by Das Gupta and Verma (1939). A consolidated account of the results of investigations on mango necrosis carried out at Lucknow under a scheme financed by the Indian (formerly Imperial) Council of Agricultural Research (1941–51) was presented in a detailed report submitted to the Council by Das Gupta (1951).

Das Gupta and Verma (*loc. cit.*) described the symptomatology of mango necrosis and reported that no fungi or bacteria were found associated with the disease and no evidence of its being a virus disease was obtained. Locally the necrosis is attributed to the deleterious effect of brick-kiln fumes, but as it does not occur in all orchards in the vicinity of brick-kilns, they concluded that some other factors must be at least partly responsible. They reported that lack of vigour in mango trees appeared to be a contributory factor in the incidence of the disease. They also observed marked differences in varietal susceptibility of mangoes, the fruits of Dasehri variety being found to be most severely affected. Das Gupta and Verma (1940) showed that in the absence of brick-kilns in the vicinity of the orchards, the disease could be artificially produced by injecting sterile juice of necrotic fruits in healthy mangoes.

Das Gupta and Sinha (1944) reported that the presence of a coloured deposit in the vessels of outer mesocarp in the distal end of the mango fruits was the first sign of necrosis. This result was further extended by Das Gupta, Asthana and Bhatt (1955) who made a comprehensive study of the occurrence of deposits in conducting channels of ten varieties of healthy and necrotic mangoes in fresh and preserved condition. They confirmed that no deposits occurred in conducting channels of fresh healthy mangoes and that the presence of deposits in the xylem vessels of the mango fruit was the first internal index of necrosis. They also found that the deposits induced by formalin-containing preservatives were different in character and distribution from those occurring in fresh necrotic mangoes.

Results of comprehensive epidemiological surveys of mango necrosis extending over several years made by Sen (1943 *a*, *b*) in Bihar and by Das Gupta and his school of workers in Uttar Pradesh (Das Gupta and Verma, 1939; Das Gupta, 1951) confirmed the association of brick-kilns with orchards affected by mango necrosis. A number of studies on the effect of brick-kiln fume and its constituents were made. It was found that gases like sulphur dioxide and ethylene cause deleterious effects on mangoes but these effects were different from the typical symptoms of mango necrosis (Pal, Chatterji and Ranjan, *loc. cit.*; Ranjan and Jha, 1940; Sen, Mallik and Roy, 1943; Das Gupta, Verma and Sinha, 1941; Das Gupta, Verma and Asthana, 1944; Verma, 1952). Experiments were also made to test the effect of artificial

fumigation on mangoes by burning various fuels in miniature brick-kilns erected in healthy mango orchards. The percentage of necrotic mangoes obtained by Sen *(1943 a)* in such experiments was considerably higher than that obtained at Lucknow (Das Gupta, 1951). Direct evidence of the causal relation of brick-kiln fumes to mango necrosis was furnished by Das Gupta *et al.* (1950) who showed that a crystalline fraction of the ether-soluble constituents of brick-kiln fumes was capable of causing necrosis in mango fruits.

LICHENS

Our knowledge of the Indian Lichens is mainly based on the fragmentary collections which the foreign botanists of the nineteenth century made while exploring the Angiosperm Flora of India. No organised, extensive and intensive collections have ever been made in India by a specialist of this branch. The comparatively small number of the micro-lichens so far reported from India, in spite of their abundance, indicates that the lichens had been mostly collected when they were unavoidably conspicuous. The number of lichen species described from India so far hardly exceeds a thousand species. Even from among these, the specimens of only a few species exist in the Indian herbaria; such as those of S. Kurz and G. Watt at the Calcutta Herbarium and Strachey, Winterbottom and Duthie at the Dehra Dun Herbarium. The absence of a proper lichenological herbarium has been a great handicap for the progress of lichenological studies in India. During recent years, Awasthi, working at the Lucknow University, has accumulated a large collection of lichens from different parts of the country.

Till the year 1850 the lichen collections that had been made from India were those by Wallich from Eastern Himalayas and Nepal; Belanger from S. India; Perottet from Nilgherries (described by Montagne in 1842), Hooker from Darjeeling and Sikkim (described by Taylor in 1847) and Strachey and Winterbottom from Kumaon (described by Babington in 1852). Some of these and various other collections, either not described or reported earlier, numbering to 75 species, were incorporated by the great Finnish Lichenologist, W. Nylander, in his classical work 'Synopsis Methodica Lichenum' in 1860. Nylander (1867 *b*) described the lichens from Calcutta and its neighbourhood, in 1869 from Lower Bengal and 24 Parganas and in 1873 from Andamans, all collected by S. Kurz, the then Curator of Royal Botanical Garden, Calcutta. Later in 1900 he made additions to the lichen flora of Ceylon. Lichens of Ceylon from the collection made by Thwaites were earlier described by Leighton in 1869.

Muller (1892) made a critical re-examination of several collections of Indian Lichens kept in various European herbaria. He also described a large number of lichens, some of which were new species, collected by G. Watt from Manipur, Assam. At almost the same period, J. Stirton described a large number of new species of the Indian

lichens preserved in British herbaria. Hue (1892, 1898) while describing the exotic lichens of the Paris Herbarium reported several species of Indian Lichens and later in 1900 described a collection of lichens from the Nilgiris (Nilgherries) in South India.

Jatta (1911) described many new species of lichens from South India and Ceylon. Paulson (1925) from Everest region and Smith (1926, 1931) from Northern India (chiefly from Eastern and N.-W. Himalayas collected by A. C. Joshi and G. L. Chopra).

Among the first Indian workers, Quraishi (1928) listed 30 species of lichens occurring in the neighbourhood of Mussorie. In a monograph on Lichens of the Himalayas, G. L. Chopra (1934) described 75 species of Indian Lichens.

Certain new species from India were described by Choisy in 1931, and by Rasanen in 1950–51 from the collection made by Awasthi. Seventy species of lichens collected by Foreau from Palni Hills in S. India in 1932–33 were listed by Moreau and Moreau (1952). A note on the lichens of Simla was contributed by Awasthi (1953).

BIBLIOGRAPHY

ADYANTHAYA, N. R. 1946. A note on the occurrence of *Sphacelia* on *Cenchrus celiaris*. *Curr. Sci.*, **15**: 286.

AFZAL, M. 1933 *a*. A preliminary note on an abnormality of Punjab American cottons. *Proc. 20th Indian Sci. Congr.* : 62.

———. 1933 *b*. A note on a growth abnormality of Punjab American cottons. *Indian J. agric. Sci.*, **3**: 933.

——, JAGGI, S. S. AND SINGH, B. 1935. A note on a survey of the disease of malformation in the Punjab American cottons. *Ibid.*, **5**: 624.

AGARWALA, R. (MISS) AND BARUAH, H. K. 1953. On the biology of *Pestalozzia palmivorum* causing brown spots on coconut palm leaves. *Proc. 40th Indian Sci. Congr.*, pt. III: 75–76.

AGARWALA, S. C. 1943. Storage disease of potatoes. I. Factors favouring dry rot of potatoes by *Fusarium oxysporum* Schl. *Proc. 30th Indian Sci. Congr.*, pt. III: 46.

———. 1949. Storage disease of potatoes. I. The role of *Fusarium oxysporum* Schl. in the rot of potatoes. *J. Indian bot. Soc.*, **28**: 50–62.

AGHARKAR, S. P. AND BANERJEE, S. N. 1932 *a*. The occurrence of *Phytophthora parasitica* Dast. on *Boucerosia diffusa* Wt. *Proc. 19th Indian Sci. Congr.* : 298.

—— AND ——. 1932 *b*. *Fusarium* sp. causing disease of *Eichhornia crassipes* Solms. *Ibid.* :298.

—— AND ——. 1933 *a*. *Grammothele reflexa*—a new species of *Hydnaceæ* from Bengal. *Proc. 20th Indian Sci. Congr.* :302.

—— AND ——. 1933 *b*. Some Hymenomycetous fungi from Calcutta and suburbs. *Ibid.* : 303.

AGNIHOTHRUDU, V. 1953. Soil conditions and root diseases. VIII. Rhizosphere microflora of some of the important crop plants of South India. *Proc. Indian Acad. Sci.*, **37 B**: 1–13.

———. 1954 *a*. Some slime-moulds from Southern India. I. *J. Indian bot. Soc.*, **33**: 177–81.

———. 1954 *b*. Some slime-moulds from Southern India. II. *Ibid.*, **33**: 182–88.

AHMAD, S. 1934 *a*. Indian slime-moulds. *Proc. 21st Indian Sci. Congr.* :296.

———. 1934 *b*. *Indian Slime-moulds*, Lahore: Punjab Univ., pp. 34.

———. 1939 *a*. Higher fungi of the Punjab plains. I. The Gasteromycetes. *J. Indian bot. Soc.*, **18**: 47–58.

———. 1939 *b*. Higher fungi of the Punjab plains. II. The Gasteromycetes. *Ibid.*, **18**: 169–77.

———. 1941 *a*. Higher fungi of the Punjab plains. III. The Gasteromycetes. *Ibid.*, **20**: 135–43.

———. 1941 *b*. Gasteromycetes of the Western Himalayas. I. *Ibid.*, **20**: 173–82.

———. 1942. Gasteromycetes of N.W. Himalayas. II. *Ibid.*, **21**: 283–93.

———. 1949. A contribution to the fungus flora of Pakistan and India. *Indian Phytopath.*, **3**: 11–16.

———. 1950. Morphology of *Disciseda cervina*. *Mycologia*, **42**: 148–60.

AHMED, Q. A. 1949. A *Choanephora* disease of *Dolichos lablab*. Linn. *Proc. 36th Indian Sci. Congr.*, pt. III: 122.

AJREKAR, S. L. 1912 *a*. The castor rust (*Melampsorella ricini*, De Toni). *J. Bombay nat. Hist. Soc.*, **21**: 1092–95.

———. 1912 *b*. A note on the life-history of *Cystopsora oleæ* Butl. *Ann. mycol. Berl.*, **10**: 307–09.

———. 1916. On the mode of infection and prevention of the smut disease of sugarcane. *Agric. J. India*, **11**: 288–95.

———. 1926 *a*. The cause of cotton wilt in India. *J. Indian bot. Soc.*, **5**: 1–8.

———. 1926 *b*. Observations on a disease of jowar (*Sorghum vulgare*) caused by *Sphacelia* (conidial stage of *Claviceps*). *Ibid.*, **5**: 55–61.

———. 1931. Germination of the spore balls of *Tolyposporium penicillariæ* Bref. (The bajra smut). *Proc. 18th Indian Sci. Congr.*: 260.

—— AND DHARMARAJULU, K. 1929. Dimorphism in a heterothallic *Mucor*. *Proc. 16th Indian Sci. Congr.* : 246.

—— AND ——. 1931. A study of the Mucorineæ of the city of Bombay. *J. Indian bot. Soc.*, **10**: 29–34.

—— AND KAMAT, M. N. 1923. The relationship of the species of *Fusarium* causing wilt and dry rot of potatoes in W. India. *Agric. J. India*, **18**: 515–20.

—— AND LIKHITE, V. N. 1933. Observations on *Tolyposporium penicillariæ* Bref. (The bajri smut fungus). *Curr. Sci.*, **1**: 215.

—— AND PARANDEKAR, S. A. 1931. Observations on the life-history of the rust fungus *Uromyces* species on *Jasminum malabaricum* and its relation to *Uromyces hobsoni* Vize (*U. cunninghamianus* Barc.) on *Jasminum grandiflorum*. *J. Indian bot. Soc.*, **10**: 195–204.

AJREKAR, S. L. AND TONAPY, B. R. 1922. A note on the life-history of *Uromyces alæs* (Cke.) P. Magn. *J. Indian bot. Soc.*, **3**: 267–69.

ALI, M. A. 1950. Genetics of resistance of common bean virus in bean (*Phaseolus vulgaris*). *Phytopathology*, **40**: 69–79.

ALLAN, R. G. 1936. Modern mango cultivation. *Bull. Dep. Agric. Unit. Prov. Fruit Ser.* : **13**.

AMBEGAOKAR, K. N. AND YESHWANT, D. WAD. 1936. Studies in disease resistance. I. Cotton wilt and environment. *Proc. Indian Acad. Sci.*, **3 B**: 502–26.

ANAND, J. S. 1934 *a*. Copper blight of tea. *Proc. 21st Indian Sci. Congr.* : 297.

———. 1934 *b*. Internal root disease of tea. *Ibid.* : 298.

ANON. 1892. Leaf fungus on *Ehretia serrata*. *Indian For.*, **18**: 21–22.

———. 1894. Sal-leaf blight in the Dun. *Ibid.*, **20**: 156.

———. 1948. Foot-rot of rice in Madras. *Indian Fmg.*, **9**: 418–19.

ANSTEAD, R. D. 1918. The treatment of fungoid diseases on Estates. *Agric. J. India*, **13**: 95–104.

ANWAR, A. A. 1949. Factors affecting the survival of *Helminthosporium sativum* and *Fusarium lini* in soil. *Phytopathology*, **39**: 1005–19.

ARTHUR, J. C. AND CUMMINS, G. B. 1933. Rusts of the North-West Himalayas. *Mycologia*, **25**: 397–406.

ASLAM, M. 1932. A study of the wilt disease of tomato plants caused by a *Cephalosporium* sp. *Proc. 19th Indian Sci. Congr.* : 303.

ASTHANA, R. P. 1936. Antagonism in fungi as a measure of control in "Red-leg" disease of lettuce. *Proc. Indian Acad. Sci.*, **4 B**: 201–07.

———. 1945. The influence of chemical manures upon 'white rot' of *Allium*. *Ibid.*, **22 B**: 168–74.

———. 1946. Latent wither-tip infection on citrus. *Ibid.*, **24 B**: 243–45.

———. 1947 *a*. Studies on sclerotium-forming fungi. I. *Sclerotium cepivorum* Berk. and *S. tuliparum* Klebahn. Part. I. Cultural studies. *Ibid.*, **26 B**: 93–107.

———. 1947 *b*. Studies on sclerotium-forming fungi. I. *Sclerotium cepivorum* Berk. and *S. tuliparum* Klebahn. Part II. Symptoms, mode of infection and host range. *Ibid.*, **26 B**: 108–16.

———. 1947 *c*. Studies on sclerotium-forming fungi. I. *Sclerotium cepivorum* Berk. and *S. tuliparum* Klebahn. Part III. Pectinase activity and preparation. *Ibid.*, **26 B**: 117–24.

———. 1947 *d*. Diseases of *Piper betle* and their control. *Indian Fmg.*, **8**: 394–97.

———. 1947 *e*. The role of 'cuttings' in the dissemination of foot-rot of *Piper betle*. *Indian J. agric. Sci.*, **18**: 223–25.

—— AND MAHMUD, K. A. 1944 *a*. Bacterial leaf spot of *Piper betle*. *Ibid.*, **14**: 283–88.

—— AND ——. 1944 *b*. Preliminary note on a new species of *Eremascus*. *Curr. Sci.*, **13**: 285–86.

AWASTHI, D. D. 1953. Studies on the lichens of India. I. A note on lichens from Simla. *Proc. 40th Indian Sci. Congr.*, pt. III: 72–73.

AYYANGAR, G. N. R. AND HARIHARAN, P. V. 1934. *Sclerospora* sp. and suppression of the awn in sorghum. *Curr. Sci.*, **3**: 363.

AYYAR, C. S. R. 1927. A bacterial soft-rot of garden poppy. *Mem. Dep. Agric. India, Bact.*, **2**: 29–33.

AYYAR, T. S. RAMAKRISHNA. 1929. *Pythium aphanidermatum* (Eds.) Fitz. on *Opuntia dillenii* Haw. *Ibid., Bot.*, **16**: 191–201.

AZAD, R. N. 1953. *Saponaria* leaf curl. *Indian Phytopath.*, **6**: 141–43.

BABINGTON, C. 1852. Lichenes Himalayenes. *Hook. Icon. Plant.*, **4**: 243–52.

BAGCHEE, K. D. 1939. Indian forest mycology with special reference to forest pathology. Presidential Address (Sect. Bot.). *Proc. 26th Indian Sci. Congr.*, pt. II: 141–67.

—— AND BAKSHI, B. K. 1951. *Poria monticola* Murr. on chir (*Pinus longifolia* Roxb.) in India. *Nature, Lond.*, **167**: 824.

BAKSHI, B. K. 1951. Seedling blight and foot rot of cereals caused by *Fusarium avenaceum* (Fr.) Sacc. and *Fusarium culmorum* (W. G. Sm.) Sacc. *Indian Phytopath.*, **4**: 162–69.

———. 1952. *Oedocephalum lineatum* is a conidial stage of *Fomes annosus*. *Trans. Brit. mycol. Soc.*, **35**: 195.

—— AND BAGCHEE, K. D. 1950. Principal diseases and decays of oaks in India. *Indian Phytopath.*, **3**: 124–39.

BALAKRISHNAN, M. S. 1947 *a*. *Phytophthora palmivora* Butler on *Cyphomandra betacea* Sendt. and *Carica papaya* Linn. *Curr. Sci.*, **16**: 147.

———. 1947 *b*. *Phytophthora palmivora* Butler causing a seedling blight of *Hibiscus esculentus* L. *Proc. Indian Acad. Sci.*, **26 B**: 142–45.

———. 1948 *a*. South Indian Phycomycetes. I. *Pythium indicum* sp. nov. causing a fruit-rot of *Hibiscus esculentus* L. *Ibid.*, **27 B**: 161–73.

———. 1948 *b*. South Indian Phycomycetes. II. Some little known species of *Pythium* occurring in South India. *Ibid.*, **28 B**: 27–34.

—— AND KRISHNAMURTHY, C. S. 1947. Seedling blight of safflower, *Carthamus tinctorius* L. *Curr. Sci.*, **16**: 291.

BALASUBRAHMANYAN, R. AND KESAVA IYENGAR, N. 1952. Breeding for black-arm resistance in Madras. *Indian Cott. Gr. Rev.*, **6**: 9–15.

—— AND RAGHAVAN, A. 1949. Bacterial blight of cotton in Madras. *Indian Central Cott. Comm. Fourth Conf. Cotton Growing Problems in India. Report and summary of proceedings*, pp. 95–98.

BALLARD, E. AND NORRIS, D. 1923. Bacterial infection of cotton bolls. *Agric. J. India*, **18**: 40–49.

BANERJEE, S. N. 1933 *a*. Thelephoraceæ of Bengal. I. *Proc. 20th Indian Sci. Congr.* 303.

———. 1933 *b*. Comparative anatomy of Bengal species of Thelephoraceæ. *Ibid.*: 303.

———. 1936. A new species of Hydnaceæ from Bengal, *Grammothele effuso-reflexa* nov. sp. *Ann. mycol., Berl.*, **34**: 76–78.

———. 1944. A new species of Discomycetes from Bengal: *Mitrula agharkarii* sp. nov. *Sci. & Cult.*, **10**: 308–09.

—— AND BAKSHI, B. K. 1944. On the production of true pilei of *Polyporus brumalis* (Pers.) Fr. in artificial culture. *Curr. Sci.*, **13**: 102–03.

BANERJEE, S. N. AND BAKSHI, B. K. 1945. Studies in the biology of wood rotting fungi of Bengal. *J. Indian bot. Soc.*, **24**: 73–91.

—— AND CHAKRAVARTY, M. 1945 *a*. Production of sporophores in two species of *Trametes* in culture. *Proc. 32nd Indian Sci. Congr.*, pt. III: 69.

—— AND ——. 1945 *b*. On the biology of *Polyporus agaricus* Berk. *Ibid.*, pt. III: 69.

—— AND CHATTERJEE, S. B. 1945 *a*. Some observations on the identity of *Amauroderma rugosum* Nees—a rare species in Bengal. *Ibid.*, pt. III: 68.

—— AND ——. 1945 *b*. A note on the hyphal systems of the sporophore of *Amauroderma rugosum* Nees. *Ibid.*, pt. III: 68.

—— AND ——. 1956 *c*. Studies on "white rot" and "brown rot". *Ibid.*, pt. III: 68.

—— AND GANGULY, A. K. 1945. *Clavaria asterella* Atk., a new record from India. *Ibid.*, pt. III: 69.

—— AND GHOSH, T. 1945. On a collection of hymenomycetous fungi from the Sikkim Himalayas. *Ibid.*, pt. III: 69.

BARCLAY, A. 1886 *a*. On a Uredine affecting the Himalayan spruce fir (*Abies smithiana* Forbes). *J. Asiat. Soc. Beng.*, **55**: 1–11.

———. 1886 *b*. On a second species of Uredine affecting *Abies smithiana* Forbes. *Ibid.*, **55**: 140–43.

———. 1886 *c*. On a new species of Uredine parasitic on *Cedrus deodara*. *Ibid.* **55**: 223–26.

———. 1887 *a*. On the life-history of a new *Aecidium* on *Strobilanthes dalhousianus* Clarke. *Sci. Mem. med. Offrs. Army India*, **2**: 15–27.

———. 1887 *b*. *Aecidium urticæ* Schum. var. *himalayense*. *Ibid.*, **2**: 29–38.

———. 1887 *c*. Descriptive list of the Uredineæ occurring in the neighbourhood of Simla (Western Himalayas). I. *J. Asiat. Soc. Beng.*, **56**: 350–75.

———. 1889 *a*. Descriptive list of the Uredineæ occurring in the neighbourhood of Simla (Western Himalayas). II. *Ibid.*, **58**: 232–51.

———. 1889 *b*. On the life-history of a new *Cæoma* on *Smilax aspera* Linn *Sci. Mem. med. Offs. Army India*, **4**: 37–46.

———. 1890 *a*. Descriptive list of the Uredineæ occurring in the neighbourhood of Simla (Western Himalayas). III. *J. Asiat. Soc. Beng.*, **59**: 75–112.

———. 1890 *b*. On the life-history of *Puccinia Geranii silvatici* Karst. var. *himalensis*. *Ann. bot., Lond.*, **5**: 27–36.

———. 1890 *c*. On the life-history of a Himalayan *Gymnosporangium*. (*G. cunninghamianum*) nov. sp. *Sci. Mem. med. Offrs. Army India*, **5**: 71–78.

———. 1890 *d*. On a *Chrysomyxa on Rhododendron arobreum* Sm. (*C. himalense* n. sp.). *Ibid.*, **5**: 79–86.

———. 1890 *e*. On the life-history of a Uredine on *Rubia cordifolia* L. (*Puccinia colletiana* nov. sp.). *Ibid.*, **5**: 87–91.

———. 1890 *f*. On some rusts and mildews in India. *J. Bot., Lond.*, **28**: 257–61.

———. 1890 *g*. Description of a new fungus, *Aecidium esculentum* n. sp. on *Acacia eburnea*. *J. Bombay nat. Hist. Soc.*, **5**: 161–65. (A note added by D. Prain, *Ibid.*, **5**: 165–67.)

BARCLAY, A. 1891 *a*. Additional Uredineæ from the neighbourhood of Simla. *J. Asiat. Soc. Beng.*, **60**: 211–30.

———. 1891 *b*. On two autœcious Cæomata in Simla. *Sci. Mem. med. Offrs. Army India*, **6**: 65–69.

———. 1891 *c*. *Rhododendron* Uredineæ. *Ibid.*, **6**: 71–74.

———. 1891 *d*. On the life-history of a remarkable Uredine on *Jasminum grandiflorum* L. (*Uromyces cunninghamianus* nov. sp.). *Trans. Linn. Soc. Lond.*, (*Bot.*), II Ser., **3**: 141–51.

———. 1891 *e*. On the life-history of *Puccinia coronata* var. *himalayensis*. *Ibid.*, **3**: 227–36.

———. 1891 *f*. On the life-history of *Puccinia jasminichrysopogonis* nov. sp. *Ibid.*, **3**: 237–42.

———. 1892 *a*. Rusts and mildew in India. *J. Bot., Lond.*, **30**: 1–8; 40–49.

———. 1892 *b*. Leaf-fungus on *Ehretia serrata*. *Indian For.*, **18**: 21–22.

BARTHAKUR, K. (MISS) AND BARUAH, H. K. 1953. Infection of bananas by *Fusarium oxysporum* in storage. *Proc. 40th Indian Sci. Congr.*, pt. III: 73.

BARUAH, H. K. 1944. Experimental studies on the parasitism of citrus fruits by *Penicillium digitatum* Sacc. *Proc. 31st Indian Sci. Congr.*, pt. III: 77.

BASU, S. N. 1946. Observations on jute- and cellulose-decomposing micro-organisms. I. Effect of nutrient medium on the sporulation of *Chætomium chartarum* Berkley and *C. globosum* Kunze. *Indian J. agric. Sci.*, **16**: 99–102.

BAWDEN, F. C., CHAUDHURI, R. P. AND KASSANIS, B. 1951. Some properties of broad bean mottle virus. *Ann. appl. Biol.*, **38**: 774–84.

BEDI, S. K. S. 1949. Infectivity and longevity of dried cultures of *Ascochyta rabiei* (Pass.) Labr., the causal fungus of gram blight. *Indian Phytopath.*, **2**: 6–10.

——, SIKKA, M. R. AND MUNDKUR, B. B. 1949. Transmission of wheat bunt due to *Neovossia indica* (Mitra) Mundkur. *Ibid.*, **2**: 20–26.

BHAGWAGAR, P. R. 1935 *a*. Polyporaceæ of the Central Provinces. *Proc. 22nd Indian Sci. Congr.* : 252.

———. 1935 *b*. The effects of different fresh fruit juice media on certain strains of *Helminthosporium*. *Ibid.*, 253.

———. 1946. Early blight of potato in India. *Indian J. agric. Sci.*, **16**: 296–301.

BHARGAVA, K. S. 1941. *Pythium aphanidermatum* (Edson) Fitz. on *Carica papaya*. *Curr. Sci.*, **10**: 212–13.

———. 1944. Fertilization in *Isoachlya anisospora* (de Bary) Coker var. *indica* Sak. et. Bhar. *Ibid.*, **13**: 237.

———. 1945 *a*. Fertilization and oogenesis in *Isoachlya anisospora* var. *indica*. *Proc. 32nd Indian Sci. Congr.*, pt. III: 67.

———. 1945 *b*. On the formation of zoospores and their liberation in *Isoachlya anisospora* var. *indica*. *Ibid.*, pt. III: 67–68.

———. 1945 *c*. Cytological studies on some members of the family Saprolegniaceæ. I. Vital staining. *Ibid.*, pt. III: 76.

———. 1945 *d*. Cytological studies on some members of the family Saprolegniaceæ. II. The vacuome. *Ibid.*, pt. III: 76–77.

———. 1945 *e*. Cytological studies on some members of the family Saprolegniaceæ. III. The chondriome. *Ibid.*, pt. III: 77.

BHARGAVA, K. S. 1945*f*. Physiological studies of some members of the family Saprolegniaceæ. II. Sulphur and Phosphorus requirements. *Proc. Indian Acad. Sci.*, **21 B**: 344–49.

———. 1945*g*. Physiological studies of some members of the family Saprolegniaceæ. III. Nitrogen requirements. *J. Indian bot. Soc.*, **24**: 67–72.

———. 1945*h*. Physiological studies of some members of the family Saprolegniaceæ. III. Carbohydrate requirements. *Proc. 32nd Indian Sci. Congr.*, pt. III: 82.

———. 1945*i*. Physiological studies of some members of the family Saprolegniaceæ. IV. Nitrogen requirements. *Ibid.*, pt. III: 82.

———. 1945*j*. Physiological studies of some members of the family Saprolegniaceæ. V. Hydrolysis of fats. *Ibid.*, pt. III: 82.

———. 1945*h*. Physiological studies of some members of the family Saprolegniaceæ. VI. Growth substance. *Ibid.*, pt. III: 82.

———. 1945*l*. Physiological studies of some members of the family Saprolegniaceæ. VII. The effect of temperature and hydrogen-ion concentration. *Ibid.*, pt. III: 83.

———. 1951*a*. Formation and liberation of zoospores in *Isoachlya anisospora* var. *indica*. *Bot. Gaz.*, **112**: 24–31.

———. 1951*b*. Some properties of four strains of cucumber mosaic virus. *Ann. appl. Biol.*, **38**: 367–88.

BHATIA, K. L. 1933. Diseases of the tea bush. *Proc. 20th Indian Sci. Congr.*: 324.

BHATT, R. S. 1943*a*. The epispore structure of *Tilletia ajrekari* Mundkur. *Proc. 30th Indian Sci. Congr.*, pt. III: 47.

———. 1943*b*. Studies in the Ustilaginales. I. Factors affecting the germination of the sporeballs of *Tolyposporium penicillariæ* Bref.—A smut of bajra (*Pennisetum typhoideum* Stapf.). *Ibid.*, pt. III: 47.

———. 1944*a*. Studies in the Ustilaginales. II. On the mode of infection of the bajra plant (*Pennisetum typhoideum* Stapf.) by the smut *Tolyposporium penicillariæ* Bref. *Proc. 31st Indian Sci. Congr.*, pt. III: 79.

———. 1944*b*. Studies in the Ustilaginales. IV. The cytology of germination of the spores of *Tolyposporium penicillariæ*, a smut of bajra. *Ibid.*, pt. III: 79.

———. 1946. Studies in the Ustilaginales. I. The mode of infection of the bajra plant (*Pennisetum typhoideum* Stapf.) by the smut *Tolyposporium penicillariæ* Bref. *J. Indian bot. Soc.*, **25**: 163–85.

BHIDE, V. P. 1948. A comparative study of some wilt producing phytopathogenic bacteria. *Indian Phytopath.*, **1**: 70–91.

———. 1949*a*. Stomatal invasion of cabbage by *Xanthomonas campestris* (Pammel) Dowson. *Ibid.*, **2**: 132–33.

———. 1949*b*. Utilization of organic nitrogen by *Corynebacterium michiganense* (E.F.S.) Dowson and its possible bearing on parasitism. *Ibid.*, **2**: 173–75.

——, PATEL, M. K. AND DHANDE, G. W. 1951. *Fusarium* wilt of lang (*Lathyrus sativus* L.)—Isolation of wilt resistant types. *Ibid.*, **4**: 181–88.

—— AND UPPAL, B. N. 1948. A new *Fusarium* disease of lang (*Lathyrus sativus*). *Phytopathology*, **38**: 560–67.

BINDAL, A. N. AND SREENIVASAYA, M. 1945. Influence of carbohydrate to nitrogen ratio on the formation of diastase by *Aspergillus oryzæ*. *Curr. Sci.*, **14**: 21–22.

BISWAS, K. 1945. Lichen flora of India. *Proc. 32nd Indian Sci. Congr.*, pt. III: 70.

—— AND AWASTHI, D. D. 1948. Distribution of Indian lichens. *Proc. 35th Indian Sci. Congr.*, pt. III: 216.

BOSE, A. B. 1940. Fairy rings of mushrooms in Calcutta and its suburb. *Sci. & Cult.*, **6**: 423–24.

———. 1942 *a*. Necrosis of roots of *Aloe vera*. *Proc. 29th Indian Sci. Congr.*, pt. IV: 144.

———. 1942 *b*. *Alternaria* on leaves of sunflower in India. *J. Indian bot. Soc.*, **21**: 179–84.

———. 1942 *c*. Germination of ergot. *Curr. Sci.*, **11**: 439.

BOSE, R. D. 1937. The rotation of tobacco for the prevention of wilt disease in pigeon-peas (*Cajanus indicus* Spr.). *Proc. 24th Indian Sci. Congr.*: 373–74.

—— AND MISRA, S. D. 1938. Studies in Indian fibre plants, No. 6. Phyllody and some other abnormalities in flower of sann-hemp. *Indian J. agric. Sci.*, **8**: 417.

BOSE, S. K. 1953 *a*. Powdery mildew of mango in Kumaon and its control. *Proc. 40th Indian Sci. Congr.*, pt. III: 78.

———. 1953 *b*. Diseases of strawberry in Kumaon and their control. *Ibid.*, pt. III: 78.

———. 1953 *c*. A new species of *Entomophthora* on beetles. *Ibid.*, pt. III: 78–79.

———. 1953 *d*. Sooty-mould disease of citrus in the Kumaon and its control. *Ibid.*, pt. III: 79.

———. 1953 *e*. An entomogenous fungus on the citrus white-fly *Dialeurodes citri* Astum. *Ibid.*, pt. III: 79.

—— AND MATHUR, S. C. 1949. A new leaf-spot disease of castor *Ricinus communis* L. *Curr. Sci.*, **18**: 210.

BOSE, S. R. 1921 *a*. Two new species of Polyporaceæ and some Polypores new to Bengal. *Proc. 8th Indian Sci. Congr.* : 176.

———, 1921 *b*. Two new species of Polyporaceæ. *J. Indian Bot.*, **2**: 300–301.

———. 1921 *c*. On new species of Polyporaceæ and some Polypores new to Bengal. *Ann. mycol., Berl.*, **19**: 129–31.

———. 1922 *a*. Une Polyporacée nouvelle du Bengale. *Bull. Soc. Myc. de France*, **38**: 173.

———. 1922 *b*. Geographical distribution of the Bengal species of Polyporaceæ along with a short history of them in Bengal. *Proc. 9th Indian Sci. Congr.*: 117.

———. 1922 *c*. Geographical distribution of the Bengal species of Polyporaceæ along with a short history of them in Bengal. *J. Indian bot. Soc.*, **3**: 19–21.

———. 1924. Three new species of Bengal Polyporaceæ. *Bot. Gaz.*, **78**: 119–21.

———. 1925. A new species of Polyporaceæ from Bengal. *Ann. Mycol., Berl.*, **23**: 179–81.

———. 1926. A preliminary account of the investigation on "Agaru". *Proc. 13th Indian Sci. Congr.* : 224.

BOSE, S. R. 1928 *a*. Artificial culture of *Ganoderma lucidus* Leyss from spore to spore. *Proc. 15th Indian Sci. Congr.*: 229.

———. 1928 *b*. The golgi bodies in higher fungi. *Ibid.*: 229.

———. 1929 *a*. Artificial culture of *Ganoderma lucidus* Leyss. from spore to spore. *Bot. Gaz.*, **87**: 665.

———. 1929 *b*. Revival of an old fruit-body of *Hexagonia discopoda* Pat. and successful spore culture from its fresh spore discharge. *Ann. mycol., Berl.*, **27**: 321–23.

———. 1929 *c*. Further work on golgi bodies in higher fungi. *Proc. 16th Indian Sci. Congr.* : 235–36.

———. 1931. A short note on the abnormal anatomy of the sporophore of *Ganoderma lucidum* (Leyss.) Fr. *Proc. 18th Indian Sci. Congr.* : 263.

———. 1932 *a*. A luminous agaric from South Burma. *Proc. 19th Indian Sci. Congr.* : 296.

———. 1932 *b*. Cytology of secondary spore-formation in *Ganoderma*. *Ibid.*: 296.

———. 1933 *a*. Abnormal spores of some *Ganoderma*. *Mycologia*, **25**: 431–34.

———. 1933 *b*. Theories of sex in fungi. *Proc. 20th Indian Sci. Congr.*: 302.

———. 1934 *a*. A short note on the presence of clamps in the sporophore of *Ganoderma lucidus* (Leyss) Fr. growing in nature. *Proc. 21st Indian Sci. Congr.*: 296.

———. 1934 *b*. A luminous agaric (*Pleurotus* sp.) from South Burma. *Trans. Brit. mycol. Soc.*, **19**: 97–101.

———. 1934 *c*. A short note on the presence of clamps in the sporophore of *Ganoderma lucidum* (Leyss) Fries growing in nature. *Ann. mycol., Berl.*, **32**: 118.

———. 1935 *a*. The distribution of some Polypores at our high altitudes. *Ibid.*, **33**: 201.

———. 1935 *b*. The distribution of Polypores at high altitudes. *Proc. 22nd Indian Sci. Congr.* : 251.

———. 1935 *c*. A note on the variation of pores of *Polystictus xanthopus* Fr. and *P. flabelliformis* Kl. at high altitudes. *Ibid.* : 251.

———. 1935 *d*. Cytology of secondary spore-formation in *Ganoderma*. *Phytopathology*, **25**: 426–29.

———. 1936. A note on the variation of pores of *Polystictus xanthopus* Fries and *Polystictus flabelliformis* Kl. at high altitudes. *Trans. Brit. mycol. Soc.*, **20**: 185.

———. 1937 *a*. A fringe within the pore-tubes of *Dædalea flavida* Lev. *Proc. 24th Indian Sci. Congr.*: 259.

———. 1937 *b*. The presence of encrusted cystidia in the hymenium of *Polyporus zonalis* Berk. *Ibid.* : 259.

———. 1937 *c*. Polyporaceæ from Lokra Hills (Assam). *Ann. mycol. Berl.*, **35**: 119–37.

———. 1937 *d*. Cytological study of basidia of Polyporaceæ. *J. Indian bot Soc.*, **16**: 119–28.

BOSE, S. R. 1939 *a*. An abnormal sterile form of *Polystictus sanguineus* Linn. *Proc. 26th Indian Sci. Congr.*, pt. III: 116.

———. 1939 *b*. Pinkish vacuolar stain in growing tips of fungal hyphæ in artificial culture. *Curr. Sci.*, **8**: 170.

———. 1943 *a*. "Agaru" production by fungal inoculation in *Aquilaria agallocha* trees in Assam. *Proc. 30th Indian Sci. Congr.*, pt. III: 45.

———. 1943 *b*. Moisture-relation as a determinant factor in the transformation of the basidia of certain Polyporaceæ. *Mycologia*, **35**: 33–46.

———. 1944. Importance of anatomy in systematics of Polyporaceæ. *J. Indian bot. Soc.*, **23**: 153–57.

———. 1949 *a*. A truffle (*Tuber* sp.) from Kodaikanal Hills (Madras). *Proc. 36th Indian Sci. Congr.*, pt. III: 123.

———. 1949 *b*. Horse-hair fungus from Bengal. *Ibid.*, pt. III, 123.

—— AND BOSE, A. B. 1940. An account of edible mushrooms of India. *Sci. & Cult.*, **6**: 141–49.

—— AND CHATTERJEE, P. (MISS). 1950. A case of apparent symbiosis of *Lagerstræmia flos-reginæ* Retz. with *Marasmius campanella* Holt. *Proc. 37th Indian Sci. Congr.*, pt. III: 56.

—— AND CHOUDHURY, A. C. 1944. A preliminary note on *Polyporium*. *Curr. Sci.*, **13**: 233.

BRUHL, P. AND SEN-GUPTA, J. 1927. Indian slime fungi (Myxomycetes or Mycetozoa). *J. Dep. Sci., Calcutta Univ.*, **8**: 101–22.

BURNS, W. 1910. First experiments in the treatment of grape vine mildew in the Bombay Presidency. *Bull. Dep. Agric. Bombay*, **36**: 16.

BUTLER, E. J. 1903 *a*. Potato diseases of India. *Agric. Ledger*, **4**: 112–19.

———. 1903 *b*. Report on 'Spike' disease among sandalwood trees. *Indian For.*, **29**: 1.

———. 1905 *a*. Some Indian forest fungi—Pt. I. *Ibid.*, **31**: 487–96.

———. 1905 *b*. Some Indian forest fungi—Pt. II. *Ibid.*, **31**: 548–56.

———. 1905 *c*. Some Indian forest fungi—Pt. III. *Ibid.*, **31**: 611–17.

———. 1905 *d*. Some Indian forest fungi—Pt. IV. *Ibid.*, **31**: 670.

———. 1906 *a*. Fungus diseases of sugarcane in Bengal. *Mem. Dep. Agric. India, Bot.*, **1**: 1–53.

———. 1906 *b*. The wilt disease of pigeon-pea and pepper. *Agric. J. India*, **1**: 25–36.

———. 1906 *c*. Some diseases of palms. *Ibid.*, **1**: 299–310.

———. 1907 *a*. An account of the genus *Pythium* and some chytridiaceæ. *Mem. Dep. Agric. India, Bot.*, **1**: 1–160.

———. 1907 *b*. Some diseases of cereals caused by *Sclerospora graminicola*. *Ibid.*, **2**: 1–24.

———. 1907 *c*. Diseases of grape vines in the Deccan. *Agric. J. India*, **2**: 94–95.

———. 1907 *d*. Mulberry disease in Kashmir. *Ibid.*, **2**: 97–98.

———. 1907 *e*. Indigo wilt in Bihar. *Ibid.*, **2**: 390.

BUTLER, E. J. 1908 *a*. Travancore coconut disease. *Agric. J. India.*, **3**: 177–79.

———. 1908 *b*. Bunt in wheat. *Ibid.*, **3**: 180–81.

———. 1908 *c*. Selection of pigeon-pea for wilt disease. *Ibid.*, **3**: 182–83.

———. 1909. *Fomes lucidus*, a suspected parasite. *Indian For.*, **35**: 514–18.

———. 1910 *a*. The bud-rot of palms in India. *Mem. Dep. Agric. India, Bot.*, **3**: 1–64.

———. 1910 *b*. A new genus of Uredinaceæ. *Ann. Mycol., Berl.*, **8**: 444–48.

———. 1911 *a*. On *Allomyces*, a new aquatic fungus. *Ann. Bot., Lond.*, **25**: 1023–34.

———. 1911 *b*. The leaf spot of turmeric (*Taphrina maculans* sp. nov.). *Ann. mycol., Berl.*, **9**: 36–39.

———. 1912. The rusts of wild vines in India. *Ibid.*, **10**: 153–58.

———. 1913 *a*. The downy mildew of maize. [*Sclerospora maydis* (Rac.) Butler]. *Mem. Dep. Agric. India, Bot.*, **5**: 275–80.

———. 1913 *b*. *Pythium de Baryanum* Hesse. *Ibid.*, **5**: 262–67.

———. 1914 *a*. Tikka disease and the introduction of exotic groundnuts in the Bombay Presidency. *Agric. J. India*, **9**: 59–70.

———. 1914 *b*. Rotting of pomegranates. *Ibid.*, **9**: 205–06.

———. 1914 *c*. Notes on some rusts in India. *Ann. mycol., Berl.*, **12**.

———. 1917. The dissemination of parasitic fungi and international legislation *Mem. Dep. Agric. India, Bot.*, **9**: 1–73.

———. 1918. *Fungi and Disease in Plants*. 547 pp., Thacker, Spink & Co. Calcutta.

———. 1926. The wilt disease of cotton and sesamum in India. *Agric. J. India*, **21**: 268–73.

—— AND BISBY, G. R. 1931. The fungi of India, Calcutta. *Sci. Monog. Coun. agric. Res. India*, **1**: xviii + 237 pp.

—— AND KHAN, A. H. 1913 *a*. Red rot of sugarcane. *Mem. Dep. Agric. India, Bot.*, **6**: 151–78.

—— AND ——. 1913 *b*. Some new sugarcane diseases. *Ibid.*, **6**: 181–208.

—— AND KULKARNI, G. S. 1913. Colocasia blight caused by *Phytophthora colocasiæ* Rac. *Ibid.*, **5**: 233–61.

CAPOOR, S. P. 1949 *a*. The movement of tobacco mosaic virus and potato virus 'X' through tomato plants. *Ann. appl. Biol.*, **36**: 307.

———. 1949 *b*. Feeding methods of the cotton white-fly. *Curr. Sci.*, **18**: 82–83.

———. 1950 *a*. A mosaic disease of sann-hemp in Bombay. *Ibid.*, **19**: 22.

———. 1950 *b*. Sterility disease of Pigeon-pea. *Proc. 37th Indian Sci. Congr.*, pt. III.

———. 1950 *c*. Mosaic disease of *Datura alba*. *Ibid.*, 56–59; 75–92.

———. 1950 *d*. Observations on 'Sterility' disease of pigeon-pea. *Indian J. agric. Sci.*, **22**: 271.

———. 1952. Culture box: A practical device for collecting, preserving and transporting virus affected plant materials. *Ibid.*, **22**: 299–302.

CAPOOR, S. P. AND VARMA, P. M. 1948 *a*. Enation mosaic of *Dolichos lablab*, a new virus disease. *Curr. Sci.*, **17**: 57–58.

—— AND ——. 1948 *b*. A mosaic disease of *Datura alba*. *Ibid.*, **17**: 151.

—— AND ——. 1948 *c*. Yellow mosaic of *Phaseolus lunatus*. *Ibid.*, **17**: 152–53.

—— AND ——. 1948 *d*. A mosaic disease of *Carica papaya* in Bombay Province. *Ibid.*, **17**: 265–66.

—— AND ——. 1948 *e*. A mosaic disease of *Lagenaria vulgaris* in Bombay Province. *Ibid.*, **17**: 274–75.

—— AND ——. 1949. The movement of tobacco mosaic virus and potato virus 'X' through tomato plants. *Ann. appl. Biol.*, **36**: 274–75.

—— AND ——. 1950 *a*. A new virus disease of *Dolichos lablab*. *Curr. Sci.*, **19**: 248–49.

—— AND ——. 1950 *b*. Yellow vein mosaic of *Hibiscus esculentus*. *Indian J. agric. Sci.*, **20**: 217–30.

—— AND ——. 1952. Studies on the 'distortion mosaic' virus of *Datura inoxia*, Mill. *Ibid.*, **22**: 303–14.

—— AND ——. 1953. Bhendi mosaic and its control in Poona. *Indian Fmg.*, N.S., **2** (12): 14–15, 31.

——, —— AND UPPAL, B. N. 1947. A mosaic disease of *Vigna catjang*. *Curr. Sci.*, **16**: 151.

CHAKRABARTY, M. 1941. Production of fruit bodies of *Agaricus polyporus* Berk. in artificial culture. *Ibid.*, **10**: 26–28.

CHAKRABORTY, N. K., BASU, P. AND NANDI, P. 1952. Antibiotic acitivities of some micro-organisms isolated from Bengal. *Proc. 39th Indian Sci. Congr.*, pt. III: 38.

CHAND, H. 1937. Study of the fungal flora of the Lahore soils. *Proc. Indian Acad. Sci.*, **5 B**: 324–31.

CHATTOPADHYAY, S. B. 1952 *a*. Assessment of infection of *Helminthosporium oryzæ* Breda de Haan on Paddy. *Proc. 39th Indian Sci. Congr.*, pt. III: 35.

———. 1952 *b*. Trial of different fungicides for control of early blight disease of potato caused by *Alternaria solani* (E. & M.) Jones and Grout. *Ibid.*, pt. III: 35.

———. 1952 *c*. Trial of different seed treating fungicides for control of primary seed-borne infection of *Helminthosporium oryzæ* Breda de Haan. *Ibid.*, pt. III: 36.

—— AND CHAKRABORTY, N. K. 1952. Variations in conidial character of *Helminthosporium oryzæ* Breda de Haan. *Ibid.*, pt. III: 33–34.

——, SEN-GUPTA, S. K., DAS, N. L. AND BASU, P. Observations on the incidence of stem rot of jute caused by *Macrophomina phaseoli* (Maubl.) Ashby. *Ibid.*, pt. III: 36.

CHAUDHURI, H. 1924. A description of *Colletotrichum biologicum* sp. nov. and observations on the occurrence of a saltation in the species. *Ann. Bot., Lond.*, **38**: 735–44.

———. 1925. A study of a disease of the garden peas due to *Sclerotium* sp. *Proc. 12th Indian Sci. Congr.* : 190.

———. 1928. Green-ear disease of bajra (*Pennisetum typhoidcum* Rich.). *Proc. 15th Indian Sci. Congr.* : 223.

CHAUDHURI, H. 1929. A study of the soil flagellates and ciliates from different parts of India. *Proc. 16th Indian Sci. Congr.* : 239.

———. 1930 *a*. Wither-tip disease of jasmine caused by *Diplodia jasmini* West. *Proc. 17th Indian Sci. Congr.*: 279.

———. 1930 *b*. On the occurrence of *Acrothecium* n. sp. on grape vine in the Govt. College Botanic Garden, Lahore. *Ibid.*, 280.

———. 1930 *c*. On a disease of *Citrus malta* caused by *Verticillium tubercularioides* Speg. *Ibid.*, 280.

———. 1930 *d*. A study of the cultural characters of a fruiting *Aspergillus*. *Ibid.*, 280.

———. 1931 *a*. On a fungus parasite of *Spirogyra affinis*. *Proc. 18th Indian Sci. Congr.* : 261.

———. 1931 *b*. Note on a *Cordyceps* from Tibet. *Trans. Brit. mycol. Soc.*, **16**: 203–205.

———. 1931 *c*. Nutritive saltation in fungi. *J. Indian bot. Soc.*, **10**: 154.

———. 1932 *a*. The Science of Plant life in India—Past and Present. Presidential Address (Sect. Bot.). *Proc. 19th Indian Sci. Congr.*: 273–89.

———. 1932 *b*. Further studies on "green ear" of bajra. *Ibid.*, 299.

———. 1932 *c*. A case of penicilloid type of conidiophores in *Aspergillus nidulans*. *Ibid.*, 299.

———. 1932 *d*. *Fomes leucophæus* Mont. on *Spiræa*. *Ibid.*, 299.

———. 1932 *e*. Notes on a *Cordyceps* from Tibet. *Ibid.*, 300.

———. 1932 *f*. *Sclerospora graminicola* on bajra (*Pennisetum typhoideum*). *Phytopathology*, **22**: 241–246.

———. 1933. A case of reversion of leafy form in coconut inflorescence due to fungal infection. *Proc. 20th Indian Sci. Congr.* : 324.

———. 1934 *a*. Phytopathology in ancient India. *Proc. 21st Indian Sci. Congr.*: 296.

———. 1934 *b*. On a new species of *Saprolegnia* parasitic on fish. *Ibid.*, 296.

———. 1935 *a*. A bacterial disease of wheat in the Punjab. *Proc. Indian Acad. Sci.*, **1 B**: 579–85.

———. 1935 *b*. Simplification of spray methods in the control of diseases. *Proc. 22nd Indian Sci. Congr.*: 253–54.

———. 1936 *a*. A scheme for the dissemination of the knowledge of plant diseases in India and suggestions for control of diseases. *J. Indian bot. Soc.*, **25**: 33–37.

———. 1936 *b*. Diseases of citrus in the Punjab. *Indian J. agric. Sci.*, **6**: 92–109.

———. 1938. Molds of the Punjab. II. The Penicillia. *Proc. Indian Acad. Sci.*, **8 B**: 93–99.

———. 1939. On resistance of vernalised plants of linseed to attack by *Melampsora lini*. *Curr. Sci.*, **8**: 555–56.

———. 1940. Smuts of the Punjab. *Proc. 27th Indian Sci. Congr.*: pt. III: 132.

———. 1940–41. Diseases in plants. *Sci. and Cult.*, **7**: 90–9[illegible]

CHAUDHURI, H. 1924 *a*. A new genus of Saprolegniaceæ. *Proc. 29th Indian Sci. Congr.*, pt. IV: 19.

———. 1942 *b*. Indian water moulds—V. A new genus of the Saprolegniaceæ: *Hamidia* gen. nov. *Proc. Indian Acad. Sci.*, **15 B**: 225–30.

———. 1944. A disease of the equisetum (*E. debile* Roxb.) due to *Fusarium diversisporium* Sherb. *Curr. Sci.*, **13**: 209.

———. 1945 *a*. Studies in the diseases of plants. *Proc. 32nd Indian Sci. Congr.*: pt. III: 67.

———. 1945 *b*. *Paradiplodia* sp. on *Kalanchœ spathulata*. *Ibid.*, pt. III: 67.

—— AND BANERJEE, M. L. 1942. Indian water moulds—IV. *Proc. Indian Acad. Sci.*, **15 B**: 216–24.

—— AND HAMID, A. 1937. Studies in water-moulds—Part III. *Proc. 24th Indian Sci. Congr.*, 261.

—— AND JOHAR, D. S. 1931 *a*. *Schizophyllum commune* Fr.—a parasite of the timber trees of Lahore. *Proc. 18th Indian Sci. Congr.* : 262.

—— AND ——. 1931 *b*. The stem-end rot of citrus fruits. *Ibid.*: 262.

—— AND ——. 1934. On *Schizophyllum commune* Fr.—a parasite on trees in Lahore. *J. Indian bot. Soc.*, **13**: 67–69.

—— AND KOCHHAR, P. L. 1935 *a*. Studies in water moulds—Part I. *Proc. 22nd Indian Sci. Congr.*: 253.

—— AND ——. 1935 *b*. Indian water moulds—I. *Proc. Indian Acad. Sci.*, **2 B**: 137–54.

—— AND LOTUS, S. S. 1936. Indian water moulds—II. *Proc. Indian Acad. Sci.*: **3 B**: 328–33.

——, ——, LOTUS, S. S., BANERJEE, M. L. AND KHAN, A. H. 1947. *A Handbook of Indian Water Moulds*. Part I. Lahore: Punjab Univ.

—— AND MALLIK, S. A. 1935. A study in physiology of *Aphanomyces levis*. *Proc. 22nd Indian Sci. Congr.*: 254.

—— AND PUSHKAR NATH. 1935. Studies in the diseases of apples in northern India. I. A new leaf spot disease of apples caused by *Oothecium indicum* n. sp. *J. Indian bot. Soc.*, **14**: 101–07.

—— AND SACHAR, G. S. 1934. A study of the fungus flora of the Punjab soils. *Ann. mycol., Berl.*, **32**: 90–100.

—— AND SINGH, G. 1930. Wither-tip disease of citrus plants in the Punjab. *Proc. 17th Indian Sci. Congr.*: 280.

—— AND SINGH, J. 1934. A disease of pomegranate (*Punica granatum* Linn.) due to *Amphichœta punicæ* n. sp. *Trans. Brit. mycol. Soc.*, **19**: 139–44.

—— AND SINGH, S. 1936. Indian water moulds—II. *Proc. 23rd Indian Sci. Congr.* : 289.

—— AND UMAR, M. 1935. On some Aspergilli and Penicillia. *Proc. 22nd Indian Sci. Congr.* : 254.

—— AND ——. 1938. Molds of the Punjab—I. The Aspergilli. *Proc. Indian Acad. Sci.*, **8 B**: 79–92.

CHHINA, L. S. 1934. Some diseases of apples in Kashmir and the Punjab plains. *Proc. 21st Indian Sci. Congr.*: 297.

CHOISY, M. 1931. Lichens Nouveaux. *Bull. Soc. bot. Fr.*, **78**: 453–60.

CHONA, B. L. 1932 *a*. Studies in the physiology of parasitism. XIII. An analysis of the factors underlying specialization of parasitism with special reference to certain fungi parasitic on apple and potato. *Ann. Bot., Lond.*, **46**: 1033–050.

———. 1932 *b*. The effect of cultural conditions on the growth and sporulation of an organism belonging to the group species *Aspergillus glaucus*. *Trans. Brit. mycol. Soc.*, **17**: 221–28.

———. 1932 *c*. The occurrence in England of a potato wilt disease due to *Fusarium oxysporum* Schlecht. *Ibid.*, **17**: 229–35.

———. 1933 *a*. Storage rot of potatoes due to a species of *Fusarium*. *Proc. 20th Indian Sci. Congr.*: 306.

———. 1933 *b*. A brief review on the various diseases of bananas (plantation and storage) as occurring in the college plantation with the practical method of control of the most important ones. *Ibid.*, 306.

———. 1933 *c*. On the physiology of parasitism: an analysis of the factors underlying specialisation of parasitism with special reference to certain fungi parasitic on apple and potato. *Ibid.*, 321.

———. 1933 *d*. Preliminary investigations on the diseases of bananas occurring in the Punjab and their method of control. *Indian J. agric. Sci.*, **3**: 673–87.

———. 1943 *a*. Red-rot of sugarcane and its control. *Indian Fmg.*, **4**: 27–32.

———. 1943 *b*. Sugarcane smut and its control. *Ibid.*, **4**: 401–04.

———. 1944. Sugarcane mosaic and its control. *Ibid.*, **5**: 178–81.

———. 1947. Simple practical schedules for protection against red-rot, smut and mosaic of sugarcane. *Ibid.*, **8**: 630–32.

———. 1950. Studies in the diseases of sugarcane in India. III. Sources and modes of red-rot infection. *Indian J. agric. Sci.*, **20**: 363–85.

—— AND HINGORANI, M. K. 1950 *a*. Comparative studies of certain isolates of *Colletotrichum falcatum* Went. *Indian Phytopath.*, **3**: 196–202.

—— AND ——. 1950 *b*. Mutation in *Colletotrichum falcatum* Went, the causal organism of sugarcane red-rot. *Phytopathology*, **40**: 221–27.

—— AND MUNJAL, R. L. 1950 *a*. Notes on miscellaneous Indian fungi—I. *Indian Phytopath.*, **3**: 115–16.

—— AND ——. 1950 *b*. *Puccinia kuehnii* (Krueg.) Butler on sugarcane in India. *Curr. Sci.*, **19**: 151.

—— AND ——. 1950 *c*. A new species of *Ascochyta*. *Ibid.*, **19**: 345.

—— AND ——. 1951. A new smut on sugarcane. *Ibid.*, **20**: 301–02.

—— AND RAFAY, S. A. 1950 *a*. Studies on the sugarcane diseases of India. I. Sugarcane mosaic virus. II. Phenomenon of natural transmission and recovery from sugarcane mosaic. *Indian J. agric. Sci.*, **20**: 39–68.

—— AND ——. 1950 *b*. Studies on the sugarcane diseases in India. *Ibid.*, **20**: 69.

CHOPRA, G. L. 1931 *a*. The lichen flora of Darjeeling. *Proc. 18th Indian Sci. Congr.*: 203–64.

———. 1931 *b*. The distribution of lichens in Darjeeling and Sikkim. *Ibid.*, 264.

———. 1932 *a*. Lichens from Simla. *Proc. 19th Indian Sci. Congr.*: 304.

CHOPRA, G. L. 1932 *b*. Some new lichens from Sikkim, Himalayas. *Proc. 19th Indian Sci. Congr.*, 304.

———. 1932 *c*. Lichens from Vaishno Devi (Kashmir). *Ibid.*: 304–05.

———. 1934. *Lichens of the Himalayas. I. Lichens of Darjeeling and the Sikkim Himalayas.*, Lahore: Punjab Univ., 105 pp.

CHOWDHURY, H. P. 1932. Fungus flora of Lucknow. *Proc. 19th Indian Sci., Congr.* : 297–98.

—— AND KAMAL, M. 1950. Effect of B-indol-3-Acetic acid, Phenoxy Acetic Acid and B-Naphthoxy Acetic Acid on the growth of *Alternaria tenuis*. *Curr. Sci.*, **19**: 247.

—— AND MATHUR, R. S. 1934. The occurrence of *Choanephora cucurbitarum* (B. and Rav.) Thaxter on *Cassia tora* Linn. *Ibid.*, **3**: 423–24.

—— AND PANT, D. N. 1953. The development of the teleutospore of *Ravenelia mitteri* Syd. *Proc. 40th Indian Sci. Congr.*, pt. III: 73.

—— AND VERMA, G. S. 1944. Occurrence of phalloids in Lucknow. *Proc. 31st Indian Sci. Congr.*, pt. III: 80.

CHOWDHURY, S. 1936. A disease of *Zea mays* caused by *Colletotrichum graminicolum* (Ces.) Wils. *Indian J. agric. Sci.*, **6**: 833–43.

———. 1937. Germination of fungal spores in relation to atmosphere humidity. *Ibid.*, **7**: 653–57.

———. 1943. Research Note—A sclerotial disease of black pepper. *Ibid.*, **13**: 566.

———. 1944 *a*. Some fungi from Assam I. *Ibid.*, **14**: 230–33.

———. 1944 *b*. Diseases of pan (*Piper betle*) in Sylhet, Assam. I. The problem and its economic importance. *Proc. Indian Acad. Sci.*, **19 B**: 147–51.

———. 1944 *c*. Diseases of pan (*Piper betle*) in Sylhet, Assam. II. *Phytophthora* foot-rot and leaf-rot. *Ibid.*, **19 B**: 152–64.

CHOWDHURY, S. 1944 *d*. Diseases of pan (*Piper betle*) in Sylhet, Assam. 17. Effect of manuring on the incidence of *Phytophthora* foot-rot and leaf-rot diseases. *Ibid.*, **19 B**: 165–70.

———. 1944 *e*. Diseases of pan (*Piper betle*) in Sylhet, Assam. IV. *Rhizoctonia* root-rot. *Ibid.*, **20 B**: 229–44.

———. 1944 *f*. An *Alternaria* disease of safflower. *J. Indian bot. Soc.*, **23**: 59–65.

———. 1944 *g*. Physiology of *Cercospora sesami* Zimm. *Ibid.*, **23**: 91–107.

———. 1945 *a*. Diseases of pan (*Piper betle*) in Sylhet, Assam. V. Sclerotial wilt. *Proc. Indian Acad. Sci.*, **22 B**: 175–87.

———. 1945 *b*. Diseases of pan (*Piper betle*) in Sylhet, Assam. VI. *Glœosporium* leaf-spot. *Ibid.*, **22 B**: 188–90.

———. 1945 *c*. Heart or stem-rot of pineapple. *Indian J. agric. Sci.*, **15**.

———. 1945 *d*. *Ceratostomella* diseases of pineapple. *Ibid.*, **15**: 135–39.

———. 1945 *e*. Control of *Cercospora* blight on Til. *Ibid.*, **15**: 140.

———. 1946 *a*. A *Rhizoctonia* leaf blight of *Dioscorea*. *Curr. Sci.*, **15**: 81.

———. 1946 *b*. Wilt of pineapple in Assam. *Ibid.*, **15**: 82.

———. 1946 *c*. Mode of transmission of the bunt of rice. *Ibid.*, **15**: 111.

CHOWDHURY, S. 1946 *d*. Some studies on the smut, *Ustilago coicis* Bref., of Job's tears millet. *J. Indian bot. Soc.*, **25**: 123–30.

———. 1946 *e*. A leaf spot of *Borassus flabellifer* L. caused by *Pestalotia palmarum* Cke. *Ibid.*, **25**: 131–37.

———. 1946 *f*. VI. Effect of manuring on the Sclerotial wilt of pan (*Piper betle* L.). *Indian J. agric. Sci.*, **16**: 290–93.

———. 1946 *g*. Effect of hydrogen-ion concentration on the growth and parasitism of *Sclerotium rolfsii* Sacc. *Ibid.*, **16**: 293–96.

———. 1947 *a*. A *Gibberella* blight of rye hitherto unrecorded from India. *Curr. Sci.*, **16**: 152–53.

———. 1947 *b*. A *Glomerella* rot of *Nuna*. *Ibid.*, **16**: 384.

———. 1947 *c*. A *Cercospora* blight of jute. *J. Indian bot. Soc.*, **26**: 227–31.

———. 1948 *a*. Some fungi from Assam. II. *Indian J. agric. Sci.*, **18**: 177–84.

———. 1948 *b*. Some fungi from Assam. III. *Ibid.*, **18**: 177–84.

———. 1948 *c*. Diseases of pan (*Piper betle*) in Sylhet, Assam. VII. Effect of some soil treatments on the incidence of Sclerotial wilt. *Proc. Indian Acad. Sci.*, **28 B**: 227–39.

———. 1948 *d*. Diseases of pan (*Piper betle*) in Sylhet, Assam. VIII. Effect of temperature on the development of Sclerotial wilt of pan. *Ibid.*, **28 B**: 240–46.

———. 1949. Some studies in the *Rhizopus* rot of jack fruit. *J. Indian bot. Soc.*, **28**: 42–50.

———. 1950. Foam disease of citrus in Assam. *Curr. Sci.*, **19**: 62.

———. 1951. Studies in the bunt of rice (*Oryza sativa* L.). *Indian Phytopath.*, **4**: 25–37.

COLEMAN, L. C. 1909. The ring disease of potatoes. *Bull. mycol. Ser. Dep. Agric., Mysore*, **15.**

———. 1915. The control of Koleroga of the areca palm, a disease caused by *Phytophthora omnivora* var. *arecæ*. *Agric. J. India*, **10**: 129–36.

———. 1917. Spike disease of sandal. *Bull. mycol. Ser. Dep. Agric. Mysore*, **3.**

———. 1923. The transmission of sandal spike. *Indian For.*, **49**: 6–9.

CUNNINGHAM, D. D. 1889. Notes on the life-history of *Ravenelia sessilis* B. and *R. stictica* B. and Br. *Sci. Mem. med. Offrs. Army India*, **4**: 20–36.

—— AND PRAIN, D. 1896. A note on Indian wheat rusts. *Rec. bot. Surv. India*, **1**: 99–124.

DACOSTA, G. C. AND MUNDKUR, B. B. 1947. A revision of the genus *Phyllosticta* in India. *Proc. nat. Inst. Sci. India*, **14**: 55–63.

DAMLE, V. P. 1943. A new *Cystopus* species found on *Evolvulus alsinoides* Linn. *J. Indian bot. Soc.*, **22**: 133–36.

———. 1944. A new species of *Cystopus* found on *Cardamine subumbellata* F. & T. Anders. *J. Univ. Bombay*, **12**: 42–45.

———. 1953. Morphology and environment. *Proc. 40th Indian Sci. Congr.*, pt. III: 81.

DAS, C. R. AND RAYCHAUDHURI, S. P. 1953. A probable strain of tomato aucuba mosaic virus. *Indian Phytopath.*, **6**: 116.

DAS, M. C. 1948. Morphology and cytology of *Tilletia holci* on *Holcus mollis* L. *Indian Phytopath.*, **1**: 165–81.

———. 1949. Morphology and cytology of *Entyloma microsporum* (Unger) Schrœt. and *Urocystis anemones* (Pers.) Winter on *Ranunculus repens*. L. *Ibid.*, **2**: 108–27.

DAS GUPTA, C. (MISS), BARUAH, S. (MISS) AND NANDI, P. 1952. Selection of better strains of *Aspergillus niger* for the production of citric acid from sugars. *Proc. 39th Indian Sci. Congr.*, pt. III: 34.

DAS GUPTA, N. N., DE, M. L. AND RAYCHAUDHURI, S. P. 1951. Structure of sann-hemp (*Crotalaria juncea*) mosaic virus with electron microscope. *Nature, Lond.*, **168**: 114.

DAS GUPTA, S. N. 1930. Studies in the genera *Cytosporina, Phomopsis* and *Diaporthe*. II. On the occurrence of saltation in *Cytosporina* and *Diaporthe*. *Ann. Bot., Lond.*, **44**: 349–84.

———. 1933 *a*. Studies in the genera *Cytosporina, Phomopsis* and *Diaporthe*. III. On the pathogenicity of *Cytosporina ludibunda* and its saltants. *Ibid.*, **47**: 197–226.

———. 1933 *b*. Studies in the genera *Cytosporina, Phomopsis* and *Diaporthe*. IV. On the pathogenicity of certain strains of *Phomopsis* and *Diaporthe*. *Ibid.*, **47**: 385–400.

———. 1933 *c*. Formation of pycnidia in *Cytosporina ludibunda* by the intermingling of two infertile strains. *Ibid.*, **47**: 689–90.

———. 1934. Studies in the genera *Cytosporina, Phomopsis* and *Diaporthe*. VI. On the conversion of one strain of *Diaporthe perniciosa* into another. *Phil. Trans.*, **223 B**: 121–61.

———. 1936 *a*. Discussion on "Saltation in artificial cultures of fungi." *Proc. 23rd Indian Sci. Congr.*, 285–87.

———. 1936 *b*. On the culture behaviour of a species of *Rosellinia*. *Ibid.*: 288.

———. 1936 *c*. *Saltation in fungi*. Lucknow Univ. Studies, **5**: 1–83.

———. 1937. On the culture behaviour of a species of *Rosellinia*. I. Inhibitory effect of certain chemicals on the production of perithecia. *J. Indian bot. Soc.*, **16**: 359–70.

———. 1938. On the culture behaviour of a species of *Rosellinia*. II. Further experiments on the production of perithecia. *Proc. Indian Acad. Sci.*, **7 B**: 22–35.

———. 1951. Studies on mango necrosis: Report submitted to the Indian Council of Agricultural Research, New Delhi, 257 pp. (unpublished).

——, ASTHANA, S. N. AND BHATT, R. S. 1955. Studies in the diseases of *Mangifera indica* Linn. On the occurrence of deposits in necrotic mangoes. *Indian J. agric. Sci.*, **25**: 237–52.

—— AND BHATT, R. S. 1944. Studies in the Ustilaginales. III. The cytology and mode of spore ball formation in *Tolyposporium penicillariæ*—a smut of bajra. *Proc. 31st Indian Sci. Congr.*, pt. III: 79.

—— AND ——. 1946 *a*. Studies in the diseases of *Mangifera indica* Linn. VII. Latent infection in the mango fruit. *J. Indian bot. Soc.*, **25**: 187–203.

—— AND ——. 1946 *b*. Latent infection in the mango fruit. *Proc. 33rd Indian Sci. Congr.*, pt. III: 113.

—— AND JOHN, R. (MISS). 1953 *a*. Studies in the Indian aquatic fungi. I. On the occurrence of Indian Blastocladiales. *Proc. 40th Indian Sci. Congr.*, pt. III: 80.

DAS GUPTA, S. N. AND JOHN, R. (MISS). 1953 *b*. Studies in the Indian aquatic fungi. II. On the occurrence of Indian Monoblepharidales. *Proc. 40th Indian Sci. Congr.*, pt. III: 80.

—— AND ——. 1953 *c*. Studies in the Indian aquatic fungi. III. On the occurrence of Indian Lagenidiales. *Ibid.*, pt. III: 80–81.

—— AND ——. 1953 *d*. Studies in the Indian aquatic fungi. I. Some water moulds of Lucknow. *Proc. Indian Acad. Sci.*, **38 B**: 165–70.

—— AND KAMAL, M. 1953. Die-back disease of *Polyalthia longifolia*. *Proc. 40th Indian Sci. Congr.*, pt. III: 79.

—— AND SADASIVAN, T. S. 1945. On the occurrence of *Neotiella catharinæa* McLennan and Halsey. *Proc. nat. Acad. Sci. India*, **15**: 57–59.

—— AND SINHA, S. 1944. Studies in the diseases of *Mangifera indica* Linn. IV. Investigation into the pathological histology of fruits affected with 'black-tip' disease with a note on the anatomy of the fruit. *Ibid.*, **14**: 102–08.

—— AND VERMA, G. S. 1939. Studies in the diseases of *Mangifera indica* Linn. I. Preliminary observations on the necrosis of the mango fruit with special reference to the external symptoms of the disease. *Proc. Indian Acad. Sci.*, **9 B**: 13–28.

—— AND ——. 1940. Studies in the diseases of *Mangifera indica* Linn. II. Effect of injecting healthy mango fruits with extract from naturally occurring necrotic mangoes. *Ibid.*, **12 B**: 95–108.

——, ——, AGARWALA, S. C., RAI, J. N. AND IYER, S. N. 1950. Necrosis of the mango fruit. *Curr. Sci.*, **19**: 153.

——, —— AND ASTHANA, S. N. 1944. Detailed investigation on the effect of sulphur dioxide and other gases on the mango fruit. *Proc. 31st Indian Sci. Congr.*, pt. III: 89.

——, —— AND SINHA, S. 1941. Studies in the diseases of *Mangifera indica* Linn. III. Investigations into the effect of sulphur dioxide gas on the mango fruit. *Proc. Indian Acad. Sci.*, **13 B**: 71–82.

—— AND ZACHARIAH, A. T. (MISS). 1939. Studies in the diseases of *Mangifera indica* Linn. III. On the 'dieback' disease of the mango tree. *Proc. 26th Indian Sci. Congr.*, pt. III: 117.

—— AND ——. 1945. Studies in the diseases of *Mangifera indica* Linn. Part V. On the dieback disease of the mango tree. *J. Indian bot. Soc.*, **24**: 101–17.

DASTUR, J. F. 1913. On *Phytophthora parasitica* nov. spec. a new disease of the castor oil plant. *Mem. Dep. Agric. India, Bot.*, **5**: 177–231.

———. 1915 *a*. The potato blight in India. *Ibid.*, **7**: 163–76.

———. 1915 *b*. A rot of bananas. *Agric. J. India*, **10**: 278–84.

———. 1916 *a*. *Phytophthora* sp. on *Hevea brasiliensis*. *Mem. Dep. Agric. India, Bot.*, **8**: 217–32.

———. 1916 *b*. *Phytophthora* on *Vinca rosea*. *Ibid.*, **8**: 233–42.

———. 1917. Conditions influencing the distribution of potato blight in India. *Agric. J. India* (Spl. Congr.): 90–96.

———. 1920 *a*. The mode of infection by smut in sugarcane. *Ann. Bot. Lond.*, **34**: 391–97.

———. 1920 *b*. *Choanephora cucurbitarum*, (B. and Rev.) Thaxter on chillies (*Capsicum* spp.). *Ibid.*, **34**: 399–403.

———. 1920 *c*. Cytology of *Tilletia tritici*. *Ibid.*, **35**: 404–07.

DASTUR, J. F. 1921. Die-back of chillies (*Capsicum* spp.) in Bihar. *Mem. Dep. Agric. India, Bot.*, **11**: 129–44.

———. 1923. A mosaic disease of sugarcane in *India*. *Agric. J. India*, **18**: 505–09.

———. 1924. A preliminary account of the investigation of cotton wilt in C.P. and Berar. *Ibid.*, **19**: 251–60.

———. 1931. Cotton wilt. *Mem. Dep. Agric. India, Bot.*, **17**: 29–73.

———. 1932. Sugarcane mosaic. *4th Congr. Internat. Soc. Sugarcane Technologists. Puerto Rico. Bull.*, **24**.

——, 1935. Diseases of pan (*Piper betle*) in the Central Provinces. *Proc. Indian Acad. Sci.*, **1 B**: 778–815.

———. 1941. Pink disease of orange trees in the Central Provinces. *Indian J. agric. Sci.*, **11**: 892–901.

———. 1946. Notes on *Corticium album* Dast. and *C. salmonicolor* B. and Br. *Curr. Sci.*, **15**: 192.

———. 1947. The place of mycology in the economic development of India. *Proc. 34th Indian Sci. Congr.*, pt. IV: 84–86.

———. 1948. *Phytophthora* spp. of potatoes (*Solanum tuberosum* L.) in the Simla hills. *Indian Phytopath.*, **1**: 19–26.

—— AND PAL, B. P. Wheat rusts and their control. *Sci. and Cult.*, **13**: 91–98.

DASTUR, R. H. 1945. Studies on the periodic partial failure of the Punjab American cottons in the Punjab. XV. Formation of proteins, oil and cellulose in the soils of normal and 'tirak' affected plants. *Indian J. agric. Sci.*, **15**: 75–84.

—— AND AHAD, A. 1941. Studies on the periodic partial failure of the Punjab American cottons in the Punjab. *Ibid.*, **11**: 279–315.

—— AND ——. 1944. Studies on the periodic partial failure of the Punjab American cottons in the Punjab. XI. Trends in growth of normal and 'tirak' affected plants with special studies on bolls. *Ibid.*, **14**: 152–95.

—— AND ——. 1945. Studies on the periodic partial failure of the Punjab American cottons in the Punjab. XIV. Mineral metabolism of normal and 'tirak' affected plants. *Ibid.*, **15**: 63–74.

—— AND SINGH, M. 1942. Studies on the periodic partial failure of the Punjab American cottons in the Punjab. VII. Amelioration of 'tirak' on soils with saline subsoils. *Ibid.*, **12**: 679–96.

—— AND ——. 1943. Studies on the periodic partial failure of the Punjab American cottons in the Punjab. IX. The interrelation of manurial factors and water supply on the growth and yield of 4 F cotton on lint in sandy soil. *Ibid.*, **13**: 610–30.

—— AND ——. 1944 *a*. Studies on the periodic partial failure of the Punjab-American cottons in the Punjab. X. The interrelation of sowing date, nitrogen, water supply to spacing on growth and yield of 4 F cotton. *Ibid.*, **14**: 18–19.

—— AND ——. 1944 *b*. Studies on the periodic partial failure of the Punjab American cottons in the Punjab. XII. Further experiments on the amelioration of 'tirak'. *Ibid.*, **14**: 181–95.

—— AND SINGH, S. 1942. Studies on the periodic partial failure of the Punjab American cottons in the Punjab. VI. The effect of sodium salts on the growth and development of 'tirak'. *Ibid.*, **12**: 603–26.

DASTUR, R. H. AND SINGH, S. 1944. Studies on periodic partial failure of the Punjab American cottons in the Punjab. XIII. Manuring of cotton. *Indian J. agric. Sci.*, **14**: 325–32.

——, —— AND CHEEMA, A. S. 1945. Studies on the periodic partial failure of the Punjab American cottons in the Punjab. XVI. Application of late sowing as a general practice. *Ibid.*, **15**: 338–42.

—— AND TASHNA, U. C. 1943. Studies on the periodic partial failure of the Punjab American cottons in the Punjab. VIII. The relation of weather factors with the spread of 'tirak' in American cottons. *Ibid.*, **13**: 449–67.

DE, M. L. 1951. Electron microscopic determination of size and shape of a new plant virus (Sann-hemp mosaic). *Indian J. Phys.*, **25**: 525.

DE MELLO, I. F. 1920. Contribution to the study of the Indian Aspergilli. *J. Indian Bot.*, **1**: 158–61.

————. 1939. Two new additions to the list of the Indian Aspergilli. *Proc. Indian Acad. Sci.*, **10 B**: 218–19.

DENNIS, R. W. G. 1951. The genus *Trogia* Fr. in India. *Indian Phytopath.*, **4**: 119–22.

DE QUADROS, A. S. 1952. Mixed cropping of wheat and gram as an insurance against rust. *Proc. 39th Indian Sci. Congr.*, Pt. III: 290.

DESAI, G. H. AND LIKHITE, V. N. 1936. Physiological studies on the Gujarat cotton rot organisms. *Proc. 23rd Indian Sci. Congr.*, 437.

DESAI, M. K. 1950. Relation of food to oospore production in *Phytophthora*. *Indian Phytopath.*, **3**: 98–102.

DESAI, S. V. 1933 *a*. Studies on the nature of causative agent of the mosaic disease of tomatoes. *Indian J. agric. Sci.*, **3**: 626–39.

————. 1933 *b*. Studies on the nature of causative agent of the virus diseases of plants. *Proc. 20th Indian Sci. Congr.*, 61.

————. 1933 *c*. Occurrence of the red stripe disease of sugarcane in India, *Ibid.*: 61.

————. 1935 *a*. Organisms associated with sugarcane mosaic and their relation to mosaic virus. *Indian J. agric. Sci.*, **5**: 367–86.

————. 1935 *b*. Stinking rot of sugarcane. *Ibid.*, **5**: 387–92.

DEVARAJAN, M. R. 1946. Powdery mildew of oranges in Coorg. *Indian Fmg.*, **7**: 303–04.

—— AND AIYAPPA, K. M. 1944. Leaf fall and fruit rot disease of oranges. *Ibid.*, **5**: 512–13.

DEY, P. K. 1919. Studies in the physiology of parasitism. V. Infection by *Colletotrichum lindemuthianum*. *Ann. Bot., Lond.*, **33**: 305–12.

————. 1933. An *Alternaria* blight of the linseed plant. *Indian J. agric. Sci.*, **3**: 881–96.

—— AND NIGAM, R. S. 1933. A soft rot of apple. *Ibid.*, **3**: 663–72.

—— AND SINGH, U. B. 1939. The stem-black disease of apple in Kumaon. *Ibid.*, **9**: 703–10.

DHARMARAJULU, K. 1932. A study of the pathological anatomy of the cotton plant in connection with the wilt disease. *Ibid.*, **2**: 293–313.

DHILLON, G. S. 1939 *a*. A study of *Monascus* occurring in orange-squash. *Proc. 26th Indian Sci. Congr.*, pt. III: 118.

DHILLON, G. S. 1939 *b*. Two species of *Spicaria* from interesting habitats. *Proc. 26th Indian Sci. Congr.*, pt. III: 118.

———. 1939 *c*. *Acrothecium lunatum* on *Pennisetum typhoideum* ears. *Ibid.*, pt. III: 118.

———. 1939 *d*. Effect of certain poisonous chemicals upon spores of *Acrothecium lunatum* and *Cephalothecium roseum*. *Ibid.*, Pt. III: 118.

DIETEL, P. 1890. Uredineen aus dem Himalaya. *Hedwigia*, **29**: 259–70.

DURAISWAMI, S. AND SUBRAMANIAM, M. K. 1952. Studies on the mutagenic action of chemical and physical agencies on yeast. V. Effect of ultraviolet irradiation on a diploid brewery yeasts. *Proc. Indian Acad. Sci.*, **35B**: 155–66.

DUTT, K. M. 1937. *Alternaria* species on chilli in India. *Curr. Sci.*, **6**: 97–98.

DUTT, N. L., HUSSAINY, S. A. AND KRISHNASWAMI, M. K. 1936. A note on breeding of sugarcane varieties resistant to mosaic. *Proc. Indian Acad. Sci.*, **3B**: 425–31.

DUTTA, S. AND CHAUDHURI, H. 1944. Fungus flora of the soil and reduction of carbohydrates by them. *Proc. 31st Indian Sci. Congr.*, pt. III: 77.

EKBOTE, R. B. AND KALAMKAR, R. J. 1945. Rust damage in wheat varieties shown at different periods. *Proc. 32nd Indian Sci. Congr.*, pt. IV: 11.

—— AND ——. 1947. Damage to the wheat crop by rust in relation to variety and time of sowing. *Indian J. agric. Sci.*, **18**: 297–98.

ELLIOT, J. A. 1924. Cotton-wilt—a seed-borne disease (adapted from *J. agric. Res.*, **23**: 5), *Agric. J. India*, **19**: 444.

FINLOW, R. S. 1918. *Rhizoctonia* in jute: the inhibiting effect of potash manuring. *Ibid.*, (Spl. Congr. 1918): 65.

GADD, C. H. 1927. The relationship between the *Phytophthoræ* associated with the bud-rot disease of palms. *Ann. Bot., Lond.*, **41**: 253–80.

———. 1929. *Rhizoctonia bataticola* and tea root diseases. *Trans. Brit. mycol. Soc.*, **14**: 99–109.

—— AND LOOS, C. A. 1948. The basidiospores of *Exobasidium vexans*. *Ibid.* **31**: 229–33.

GALLOWAY, L. D. 1936 *a*. Indian soil fungi. *Indian J. agric. Sci.*, **6**: 578–85.

———. 1936 *b*. The control of fungal parasites by the plant. *Proc. Indian Acad. Sci.*, **3B**: 493–97.

—— AND SEN, R. R. 1935. An unusual rust fungus on tulip. *Indian J. agric. Sci.*, **5**: 743–44.

GANDHI, S. R. 1928. A grape vine disease new to India. *Proc. 15th Indian Sci., Congr.* : 49.

GANGULY, A. K. AND GANGULY, D. 1940. A preliminary note on the isolation and pathogenicity of *Acrothecium lunatum* Wakker and *Helminthosporium tetramera* McKinney on the leaves of *Oryza sativa* Linn. *Sci. and Cult.*, **6**: 424–25.

GANGULY, D. 1946. A note on the occurrence of *Cercospora oryzæ* Miyake on paddy in Bengal. *Ibid.*, **11**: 573.

———. 1947. Studies in the stackburn disease of rice and identity of the causal organism. *J. Indian bot. Soc.*, **26**: 233–39.

GARG, D. N. 1948. *Pellicularia filamentosa* (Pat.) Rogers, comb. nov. causing a rot of Bers. (*Trifolium alexandrinum* Linn.) in the United Provinces. *Curr. Sci.*, **16**: 270.

GARG, R. P. 1949. *Schizanthus* sp. a host of tobacco leaf curl virus. *Curr. Sci.*, **18**: 260–61.

———. 1953. Preliminary observations on a virus disease of *Thevetia neriifolia*. *Ibid.*, **22**: 243.

GATTANI, M. L. 1950 *a*. Control of secondary infection of downy mildew of maize. *Ibid.*, **19**: 90.

———. 1950 *b*. Induced lysis in the germination of the uredospores of the wheat rusts. *Ibid.*, **19**: 217.

———. 1951 *a*. Induced variation in the germination of chlamydospores of *Ustilago scitaminea*. *Ibid.*, **20**: 134.

———. 1951 *b*. Adaptation of fungi to fungicides and its significance in agriculture. *Ibid.*, **20**: 242–43.

———. 1951 *c*. Adaptation of fungi to fungicides and its significance in agriculture. *Indian Phytopath.*, **4**: 174–80.

———. 1952. Hydrophobic colloidal sulphur spray for wheat rust control. *Proc. 39th Indian Sci. Congr.*, pt. III: 307.

—— AND KAUL, T. N. 1949. Studies on penicillin producing strains of *Penicillium notatum* chrysogenum series in India. *Proc. 36th Indian Sci. Congr.*, pt. III: 201–02.

—— AND ——. 1951. Damping-off of tomato seedlings—its cause and control. *Indian Phytopath.*, **4**: 156–61.

GHATAK, P. N. 1938. Investigation on orange rot in storage. I. Orange rot due to two strains of *Fusarium moniliforme* Sheldon. *J. Indian bot. Soc.*, **17**: 141–48.

—— AND ROY, T. C. 1939. Studies in the soil fungi of the paddy fields of Bengal. I. Fungi of an unmanured paddy field of the Chinsurah Agricultural Farm, *Ibid.*, **18**: 113–28.

GHOSH, J. J. 1952 *a*. Studies on pH conditions for the growth of rice-inhabiting fungi. *Proc. 39th Indian Sci. Congr.*, pt. III: 34.

———. 1952 *b*. Effect of temperature on the growth of the rice-inhabiting fungi. *Ibid.*, Pt. IV: 34–35.

GHOSH, T. AND BASAK, M. 1951. Chlorosis in jute. *Sci. and Cult.*, **17**: 262.

GINAI, M. A. 1935. A contribution to our knowledge of Indian coprophilous fungi—Pt. II. *Proc. 22nd Indian Sci. Congr.* : 253.

———. 1936. Further contribution to our knowledge of Indian coprophilous fungi. *J. Indian bot. Soc.*, **25**: 269–84.

———. 1939. A note on *Botrytis* rot of grapes in the Quetta valley. *Indian J. agric. Sci.*, **9**: 719–25.

———. 1940. A species of *Phyllactinia* occurring on almond (*Prunus amygdalus*). *Ibid.*, **10**: 96–97.

GOKHALE, V. P. 1936. Preliminary observations on small leaf disease in cotton. *Ibid.*, **6**: 475.

———. 1950. A new biotype of Race 15 of *Puccinia graminis tritici*. *Curr. Sci.*, **19**: 214.

—— AND PATEL, M. K. 1951. *Kulkarniella*, a new genus of rusts. *Indian Phytopath.*, **4**: 170–73.

GOPALAKRISHNAN, K. S. 1951. Notes on the morphology of the genus *Hemileia*. *Mycologia*, **43**: 271–83.

GOVINDU, H. C. 1949. *Cerebella* on sugarcane. *Curr. Sci.*, **18**: 180.

GULATI, H. L. 1930. Anthracnose of chilli (*Capsicum annuum*) due to *Colletotrichum nigrum* E. and Halls. *Proc. 17th Indian Sci. Congr.*: 281.

GUPTA, B. L. 1929. Some observations and experiments on rusts and mildews of wheat and barley. *Proc. 16th Indian Sci. Congr.*: 233.

———. 1930. Preliminary observations and experiments on *Uromyces* sp. on *Euphorbia dracunculoides*. *Proc. 17th Indian Sci. Congr.*: 282.

GUPTA, B. M. AND PRICE, W. G. 1950. Production of plant virus inhibitors by fungi. *Phytopathology*, **40**: 642–52.

—— AND ——. 1952. Mechanism of inhbition of plant virus infection by fungal growth products. *Ibid.*, **42**: 45–51.

GUPTA, D. D. 1951. Sporulation and aversion in *Eurotium herbariorum* (Wigg.). *Indian Phytopath.*, **4**: 106–15.

GUPTA, S. C. AND SINHA, S. 1951. Further additions to the Synchytria of India. *Ibid.*, **4**: 7–10.

HAFIZ, A. 1946. Brown rot of stone and pome fruits. *Punjab Fr. J.*, **10**: 145–46.

———. 1947. Peach leaf curl. *Ibid.*, **11**: 178–79.

———. 1951. Cultural studies on *Ascochyta rabiei* with special reference to zonation. *Trans. Brit. mycol. Soc.*, **34**: 259–69.

HAMID, A. 1937. Fleshy fungi of Kashmir. I. *Proc. 24th Indian Sci. Congr.*: 261.

———. 1942 *a*. Some new water moulds from the Punjab. *Proc. 29th India Sci. Congr.*, pt. IV: 19.

———. 1942 *b*. Indian water moulds—III. *Proc. Indian Acad. Sci.*, **15 B**: 206–15.

HIDAYETULLAH, S. AND RAYCHAUDHURI, S. P. 1941. Sclerotial disease of rice caused by *Sclerotium oryzæ* Cantt. *Sci. and Cult.*, **7**: 369–70.

—— AND SAHA, J. C. 1941. Bacterial wilt disease of tomato. *Ibid.*, 226–27.

HINGORANI, M. K. 1951 *a*. The effect of temperature and light on the mesothetic reaction of Josham oats to stem rust. *Indian Phytopath.*, **4**: 85–87.

———. 1951 *b*. Selfing studies with race 7 of *Puccinia graminis avenæ* Erikss. and Hann. *Ibid.*, **4**: 141–43.

———. 1951 *c*. Bacterial soft rot of peas. *Curr. Sci.*, **20**: 191.

—— AND ADDY, S. K. 1953. Factors influencing bacterial soft rot of potatoes. *Indian Phytopath.*, **6**: 110–15.

—— AND MALLA, D. S. 1951. Bacterial soft rot of onions in storage. *Ibid.*, **4**: 58–59.

—— AND PRASAD, N. 1951. Seedling blight of rice in Sind. *Ibid.*, **4**: 60–63.

HOLMES, F. O. 1949. Problems in research on viruses and viral diseases. *Ibid.*, **2**: 39.

HOLTON, C. S. 1949. Observations on *Neovossia indica*. *Ibid.*, **2**: 1–5.

HORNE, A. S. AND DAS GUPTA, S. N. 1929. Studies in the genera *Cytosporina Phomopsis* and *Diaporthe*. I. On the occurrence of an 'ever-salting' strain in *Diaporthe*. *Ann. Bot., Lond.*, **43**: 417–35.

HUE, A. 1892. *Lichenes exotici a professore W. Nylander descripti vel recogniti*, Paris, Masson.

———. 1898. Lichenes extra-europæi a pluribus collectoribus ad Museum Parisieuse missi. *Nouv. Arch. Mus. Hist. Nat., Paris*, **10**: 1–68.

HUGHES, S. J. 1951. *Sclerographium aterrimum* Berkeley. *Indian Phytopath.*, **4**: 5–6.

HUSSAIN, S. M. 1952. A new species of *Fomes* from Pakistan. *Mycologia*, **44**: 823–26.

HUTCHINSON, C. M. 1913. Rangpur tobacco wilt. *Mem. Dep. Agric. India, Bact.*, **1**: 67–83.

———. 1917. A bacterial disease of wheat in the Punjab. *Ibid.*, **1**: 169–75.

IYENGAR, A. V. V. 1928. Contributions to the study of spike disease of sandal. Leaf analysis and physico-chemical study of leaf sap. *J. Indian Inst. Sci.*, **11**: 97–109.

———. 1929. Contributions to the study of spike disease of sandal. *Ibid.*, **12**: 295.

———. 1933 *a*. Studies on the spike disease of *Vinca rosea*. *Proc. 20th Indian Sci. Congr.*: 323.

———. 1933 *b*. Studies on the eradication of spike disease of sandal. I. Use of arsenicals and other chemicals. *Ibid.*, 323.

———. 1934. Contributions to the study of spike disease of sandal. *J. Indian Inst. Sci.*, **17**: 131.

———. 1935 *a*. Deamination in virus infected plants. *Nature, Lond.*, **135**: 345.

———. 1935 *b*. Contributions to the study of spike disease of sandal. *J. Indian Inst. Sci.*, **18**: 61.

———. 1936. Lime in relation to spike disease of sandal. *Chron. bot.*, **4**: 205–06.

———. 1938 *a*. Contributions to the study of spike disease of sandal. *J. Indian Inst. Sci.*, **21**: 89.

———. 1938 *b*. Some aspects of control of spike disease. *Phytopathology*, **28**: 715.

—— AND RANGASWAMI, S. 1935. Studies on the control of spike disease of sandal. *Indian For.*, **61**: 25.

IYENGAR, M. O. P. 1933. Contributions to our knowledge of the colonial Volvocales of S. India. *J. Linn. Soc. (Bot.)*, **49**: 366–69.

———. 1937. *Clathropsis*, a new genus of the Phalloideæ. *Proc. 24th Indian Sci. Congr.*: 259.

JAIN, A. C. 1951. A bacterial disease (canker) of tomatoes new to India. *Sci. & Cult.*, **17**: 46–47.

JATTA, A. 1911. Lichenes Asia meridionalis lect. a rev. B. Luthi in Malabar et a E. Long et. w. Gollan in Himalaya. *Bull. Orts. bot.* d. R. *Univ. Napoli.*, **3**: 309–12.

JHINGAN, D. K. 1933. Die-back and anthracnoses of chillies. *Proc. 20th Indian Sci. Congr.*: 350.

JIVANA RAO, P. S. 1921 *a*. Physiological anatomy of spiked leaf of sandal. *Indian For.*, **47**: 351–60.

———. 1921 *b*. The physiological anatomy of the spiked leaf in sandal. *Proc. 8th Indian Sci. Congr.*: 17.

———. 1925. The virus theory in relation to spike disease in sandal. *Rep. Imp. Bot. Conf. Lond.*, 357–59.

JOHAR, D. S. 1931 *a*. Leprosis or the nail head rust of citrus trees. *Proc. 18th Indian Sci. Congr.* : 262.

———. 1931 *b*. The sooty mould of the citrus plants in the Punjab. *Ibid.*, 262–63.

JOSHI, S. D. 1924. The wilt disease of Safflower. *Mem. Dep. Agric. India, Bot.*, **31**, 39–46.

KALYANASUNDARAM, R. 1952. Ascorbic acid and *Fusarium* wilted plants. *Proc. Indian Acad. Sci.*, **36 B**: 102–04.

———. 1954 *a*. Soil conditions and root diseases. XII. The role of zinc and manganese in altering host metabolism. *J. Indian bot. Soc.*, **33**: 197–202.

———. 1954 *b*. Soil conditions and root diseases. XIII. Symptomatology of *Fusarium* wilt. *Ibid.*, **33**: 329–37.

KAMAL, M. 1950. Leaf blight of *Pandanus* spp. *Curr. Sci.*, **19**: 125.

———. 1951. *Stemphyllium ilicis* on *Livistona mauritiana* Wall. *Ibid.*, **20**: 276–77.

———. 1953. Leaf blight of *Blighia sapida* Akee. *Proc. 40th Indian Sci. Congr.*, pt. III: 75.

———. 1954. Physiological studies of cotton wilt and its causal organism *Verticillium dahliæ* (*Ph.D. Thesis*, London University).

KAMAT, M. N. 1927 *a*. Gummosis of citrus trees in the Bombay Presidency. *Proc. 14th Indian Sci. Congr.*: 213.

———. 1927 *b*. The control of mosambi (*Citrus aurantium*) gummosis. *Agric. J. India*, **22**: 176–79.

———. 1933. Observations on *Tolyposporium filiferum*, cause of 'long smut' of sorghum. *Phytopathology*, **23**: 985–92.

—— AND PATEL, M. K. 1948. Some new hosts of *Oidiopsis taurica* (Lev.) Salmon in Bombay. *Indian Phytopath.*, **1**: 153–58.

KANITKAR, U. K. AND UPPAL, B. N. 1939. Twig blight and fruit rot of mango. *Curr. Sci.*, **8**: 470–71.

KAPUR, V. S. 1932 *a*. Grey blight of tea due to *Pestalozzia theæ* Sawada. *Proc. 19th Indian Sci. Congr.* : 302.

———. 1932 *b*. Brown spot disease due to *Phoma theicola* Petch. *Ibid.*, 303.

KAR, A. K. 1951. On the occurrence of white rust on *Amaranthus polygamus* Linn. *J. Bombay nat. Hist. Soc.*, **48**: 197–98.

KAR, P. C. AND SAHA, J. C. 1943. 'A new stem base disease of *Altissima* caused by a species of *Phytophthora*.' *Curr. Sci.*, **12**: 229.

KHAN, A. H. 1923. *Polyporus gilvus* (Schw.) Fr. and Pat., a suspected root parasite of shisham (*Dalbergia sisoo*). *Indian For.*, **49**: 503–06.

KHAN, A. H. 1925. The artificial development of sporophores of *Polyporus gilvus*. (Schw.) Fr. and Pat. *Indian For.*, **51**: 205–07.

KHANNA, K. L. AND RAMANATHAN, K. R. 1946. A note on the occurrence of smut in *Saccharum manja*, Munj grass. *Curr. Sci.*, **15**: 253.

KHANNA, M. L. AND GANGULY, B. 1953. Loss in yield in Craig's defiance potato variety due to virus 'Y'. *Sci & Cult.*, **19**: 257.

KHESWALLA, K. F. 1934. Stem rot of tobacco caused by *Sclerotinia sclerotiorum* (Lib.) de Bary. *Indian J. agric. Sci.*, **4**: 663–73.

———. 1935. Seedling blight of *Cinchona ledgeriana* Mœns. caused by *Phytophthora palmivora* Butl. in the Darjeeling district. *Ibid.* **5**: 485–95.

———. 1936. A *Phoma* disease of *Asparagus*. *Ibid.*, **6**; 800–02.

———. 1941. Foot rot of gram (*Cicer arietinum* L.) caused by *Operculella padwickii* gen. nov., sp. nov. *Ibid.*, **11**: 316–18.

KNIGHT, R. L. 1948. The genetics of black-arm resistance. *J. Genet.*, **48**: 359–87.

—— AND HUTCHINSON, J. B. 1950. The evolution of black-arm resistance in Cotton. *Ibid.*, **50**: 36–58.

KOTTUR, G. L. 1924. Notes on cotton-wilt in Southern Maratha country. *Agric. J. India*, **19**: 155–59.

———. 1932. Breeding for disease resistance at Dharwar. *Curr. Sci.*, **1**: 78.

—— AND DESAI, M. K. 1934. Studies in disease resistance with special reference to cotton wilt. *Proc. 21st Indian Sci. Congr.*: 78–79.

—— AND MARALIHALLI, S. S. 1934. Relative susceptibility of cotton to wilt. *Ibid.*: 78.

—— AND PATEL, M. L. 1920. Malformation of the cotton plant leading to sterility *Agric. J. India*, **15**: 640–43.

KRISHNAMURTHY, C. S. AND RANGASWAMI, G. 1947. *Hemileia jasmini* Krishnamurthy and Rangaswami sp. nov. on *Jasminum ritchiei* Clarke. *Curr. Sci.*, **16**: 31.

KRISHNAN, P. S. 1951. Apyrases of moulds. *Nature, Lond.*, **168**: 171.

KRISHNASWAMI, C. S. 1936. Studies in disease resistance in crop plants in the Madras Presidency. II. Estimation of disease resistance in sugarcane mosaic. *Proc. Indian Acad. Sci.*, **3 B**: 481–90.

KULKARNI, G. S. 1913. Observations on the downy mildew [*Sclerospora graminicola* (Sacc.) Schrœt.] of bajri and jowar. *Mem. Dep. Agric. India, Bot.*, **5**; 268–73.

———. 1922. The smut of nachani or ragi (*Eleusine coracana* Gaertn.). *Ann. appl. Biol.*, **9**: 184–86.

———. 1924. Mosaic and other related diseases of crops in Bombay Presidency. *Proc. 11th Indian Sci. Congr.*: 42.

———. 1931. Studies in the wilt disease of cotton in the Bombay Karnatak. II. The parasitism of the *Fusarium* associated with the wilt disease of cotton. *Mem. Dep. Agric. India, Bot.*, **17**: 11–20.

———. 1934. Studies in the wilt disease of cotton in the Bombay Presidency. *Indian J. agric. Sci.*, **4**: 976–1045.

———. 1941. The wilt disease of coriander (*Coriandrum sativum*) in the Gwalior State. *Proc. 28th Indian Sci. Congr.*, pt. **IV**: 263.

———. 1942. Ergot in India. *Curr. Sci.*, **11**: 246.

KULKARNI, G. S. AND MUNDKUR, B. B. 1925. Toxins excreted by the *Fusarium* causing wilt disease of cotton and their influence on the host plants. *Proc. 12th Indian Sci. Congr.*: 191.

—— AND ——. 1931 *a*. Studies on the wilt disease of cotton in the Bombay Karnatak, Series I. *Mem. Dep. Agric. India, Bot.*, **17**: 7–10.

—— AND ——. 1931 *b*. Studies in the wilt disease of cotton in the Bombay Karnatak. III. The Pathology of wilting in cotton plants. *Ibid.*, **17**: 21–27.

KULKARNI, Y. S. AND PATEL, M. K. 1951. A preliminary note on the inheritance of black-arm resistance in some strains of *Gossypium herbaceum*. *Cott. Gr. Rev.*, **3**: 148–52.

——, —— AND ABHYANKAR, S. G. 1950. A new bacterial leaf-spot and stem canker of pigeon pea. *Curr. Sci.*, **19**: 384.

——, —— AND DHANDE, G. W. 1951. *Xanthomonas cassiæ*, a new bacterial disease of *Cassia tora* L. *Ibid.*, **20**: 47.

LACY, R. C. 1949. Studies in aquatic Phycomycetes. *Indian Phytopath.*, **2**: 134–41.

———. 1950 *a*. Studies on some Indian Synchytria. I. Four new species from Bihar. *Ibid.*, **3**: 155–61.

———. 1950 *b*. Parasitic nature of *Marasmius rotula* Fr. on *Derris sinuata*. *Proc. 37th Indian Sci. Congr.*, pt. IV: 8.

———. 1950 *c*. *Tuberculina* sp. parasitic on *Puccinia butleri*. *Curr. Sci.*, **19**: 247.

LAKSHMINARAYANAN, K. 1953. Mechanism of *Fusarium* wilts of plants. *Proc. Indian Acad. Sci.*, **38 B**: 161–64.

LAL, A. 1939. Interaction of soil micro-organisms with *Ophiobolus graminis* Sacc., the fungus causing the take-all disease of wheat. *Ann. appl. Biol.*, **26**: 247–61.

—— AND TANDON, I. N. 1950. A new species of *Gloeosporium* on *Anthocephalus cadamba*. *Indian Phytopath.*, **3**: 140–47.

LAL, M. 1932 *a*. *Fusarium* wilt of potatoes. *Proc. 19th Indian Sci. Congr.*: 304.

———. 1932 *b*. Pink rot of apple. *Ibid.*, 304.

LAL, T. B. 1937. *Uromyces rumicis* (Schum.) Winter: a new record for India. *Indian J. agric. Sci.*, **7**: 933–34.

———. 1948. Occurrence of late blight of potato in the plains of India. *Indian Phytopath.*, **1**: 164.

LALL, B. B. 1940 *a*. Rusts of the Punjab and North-Western Himalayas. *Proc. 27th Indian Sci. Congr.*, pt. IV: 11.

———. 1940 *b*. Some leaf-spot diseases. *Ibid.*, Pt. IV: 11.

LEIGHTON, W. A. 1869. The Lichens of Ceylon, collected by G. H. K. Thwaites. *Trans. Linn. Soc. Lond. (Bot.)*, **27**: 161–85.

LESDAIN, B. DE. 1910. Notes lichénologiques. XII. *Bull. Soc. bot. Fr.*, **57**: 236–40.

LIKHITE, V. N. 1930. Virus diseases of tomatoes. *J. Indian bot. Soc.*, **9**: 114–25.

———. 1932 *a*. Preliminary observations on *Cercospora euphorbiæ* Kell. & Swim. *Proc. 19th Indian Sci. Congr.*: 298.

———. 1932 *b*. The probable cause of cotton root-rot in Gujarat. *Curr. Sci.*, **1**: 36.

———. 1933. A *Teichospora* on bajri. *Proc. 20th Indian Sci. Congr.*: 62.

LIKHITE, V. N. 1935 *a*. Observations on the root-rot of cotton in Gujarat. *Proc. 22nd Indian Sci. Congr.*: 372.

————. 1935 *b*. Stenosis in Gujarat cotton. *Proc. Assn. Econ. Biol., Coimbatore*, **3**: 15–17.

—— AND DESAI, G. H. 1935. Storage rot of onions. *Curr. Sci.*, **4**: 159–60.

—— AND KULKARNI, V. G. 1934. Relative parasitism of the cotton root-rot organisms from Gujarat soils. *Ibid.*, **3**: 252–54.

LINDEGREN, C. C. AND LINDEGREN, GERTRUDE. 1951. Linkage relations in *Saccharomyces* of genes controlling the fermentation of carbohydrates and the synthesis of vitamins, amino acids, and nucleic acid components. *Indian Phytopath.*, **4**: 11–20.

LUTHRA, J. C. 1933. Some new methods for control of loose smut of wheat (*Ustilago tritici*). *Proc. 20th Indian Sci. Congr.* : 63.

—— AND BEDI, K. S. 1932. Some preliminary studies on gram blight with reference to its cause and mode of perennation. *Indian. J. agric. Sci.*, **2**: 499–514.

—— AND ——. 1937. A study of cultural variations in the gram blight fungus *Phyllosticta rabiei* (Pass.) Trot. = *Aschochyta rabiei* (Pass.) Lab. *Proc. 24th Indian Sci. Congr.* : 373.

—— AND BHANDARI, L. S. 1932 *a*. A study of variation found on *Alternaria brassicæ* (Berk.) Bolle. *Proc. 19th Indian Sci. Congr.*: 301.

—— AND ——. 1932 *b*. Red-rot of Grape vines. *Ibid.*: 302.

—— AND SATTAR, A. 1934 *a*. Some experiments on the control of loose smut, *Ustilago tritici* (Pers.) Jens. of wheat. *Indian J. agric. Sci.*, **4**: 177–99.

—— AND ——. 1934 *b*. Some experiments on the control of loose smut, *Ustilago tritici* (Pers.) Jens. of wheat. *Proc. 21st Indian Sci. Congr.*: 80.

—— AND ——. 1935. Some observations on mosaic diseases of sugarcane in Punjab. *Indian J. agric. Sci.*, **5**: 649–62.

—— AND ——. 1936. Some diseases on the Sclerotial diseases of rice (*Sclerotium oryzæ* Catt.) in the Punjab. *Ibid.*, **6**: 973–84.

——, —— AND BEDI, K. S. 1935. Life-history of gram blight *Ascochyta rabiei* (Pass.) Trotter and measures for its control. *Proc. 22nd Indian Sci. Congr.* : 373–74.

——, —— AND ——. 1938. The control of the blight disease of gram by resistant types. *Curr. Sci.*, **7**: 45.

——, ——. 1939. Variation in *Ascochyta rabiei* (Pass.) Lab. the causal fungus of blight of gram (*Cicer arietinum* L.). *Indian J. agric. Sci.*, **9**: 791–805.

——, ——. 1940. Further studies on the blight disease of gram [*Ascochyta rabiei* (Pass.) Lab.] in the Punjab—Control by resistant types. *Proc. 27th Indian Sci. Congr.*, pt. III: 228–29.

——, ——. 1941. Determination of resistance to the blight disease [*Mycosphærella rabiei* Kovacewski = *Ascochyta rabiei* (Pass.) Lab.] in gram types. *Indian J. agric. Sci.*, **11**: 249–64.

——, ——. 1943. Further studies on the control of gram blight. *Indian Fmg.*, **4**: 413–16.

——, —— AND GHANI, A. 1936. Some studies on the leaf-spot disease of wheat caused by *Septoria tritici* Desm. *Proc. 23rd Indian Sci. Congr.* : 287–88.

——, —— AND GHANI, M. A. 1937. A comparative study of species of *Septoria* occurring on wheat. *Indian J. agric. Sci.*, **7**: 271–89.

LUTHRA, J. C. SATTAR, A. AND SANDHU, S. S. 1938. Life-history and modes of perpetuation of smut of sugarcane (*Ustilago scitaminea* Syd.). *Indian J. agric. Sci.*, **8**: 849–61.

——, —— AND ——. 1940 *a*. Experiments on the control of smut of sugarcane (*Ustilago scitaminea* Syd.). *Proc. Indian Acad. Sci.*, **12 B**: 118–28.

——, —— AND ——. 1940 *b*. Some studies on the physiology of *Cytospora sacchari* Butl., the causal fungus of stem canker disease of sugarcane. *Ibid.*, **12 B**: 172–88.

——, —— AND SINGH, K. 1932 *a*. Study in artificial culture of some Alternarias of the Punjab. *Proc. 19th Indian Sci. Congr.* : 301.

——, —— AND ——. 1932 *b*. Sugarcane *Colletotrichum*. *Ibid.*, 302.

——, —— AND SINGH, S. 1938. Occurrence of stem canker diseases of sugarcane (*Cytospora sacchari* Butl.) in the Punjab. *Proc. Indian Acad. Sci.*, **8 B**: 188–91.

—— AND VASUDEVA, R. S. 1938. Studies on the-root rot disease of cotton in the Punjab. V. Confirmation of the identity of *Rhizoctonia bataticola*. *Indian J. agric. Sci.*, **8**: 727–34.

—— AND ——. 1940. Mixed cropping and the cotton root rot disease (*Macrophomina phaseoli* and *R. solani*). *Curr. Sci.*, **9**: 466.

—— AND ——. 1941. Studies on the root-rot disease of cotton in the Punjab. IX. Varietal susceptibility to the disease. *Indian J. agric. Sci.*, **11**: 410–21.

——, —— AND ASHRAF, M. 1940. Studies on the root-rot disease of cotton in the Punjab. VIII. Further studies on the physiology of the causal fungi. *Ibid.*, **10**: 693–762.

MACKENZIE, A. H. (MISS). 1947. Blight disease of *Gomphrena globosa*. *Proc. 34th Indian Sci. Congr.*, pt. III: 161.

MADAN, N. S. 1939 *a*. Leaf spots of *Agave americana* Linn. caused by *Diplodia agaves*. *Proc. 26th Indian Sci. Congr.*, pt. IV: 5.

———. 1939 *b*. *Pestalozzia phœnicis* on *Phœnix dactylifera*. *Ibid.*, Pt. IV: 6.

MADHOK, M. R. AND FAZAL-UD-DIN. 1943. Bacterial soft-rot of tomatoes by a spore-forming organism. *Indian J. agric. Sci.*, **13**: 129–33.

MADHUSUDAN RAO, I. AND YESHWANT D. WAD. 1936. Studies in disease resistance. II. Leaf roll and red leaf of American cottons. *Proc. Indian Acad. Sci.*, **3 B**: 535–51.

MAHENDRA, K. R. 1930. Virus diseases of potatoes in the Punjab. *Proc. 17th Indian Sci. Congr.*: 56.

MAHESHWARI, P. AND PURI, V. 1934. A note on the occurrence of a smut on two Indian Selaginellas. *Curr. Sci.*, **3**: 301.

MAHMUD, K. A. 1950 *a*. A new root-rot disease of *Cyperus* spp. *Ibid.*, **19**: 65.

———. 1950 *b*. Damping-off of cabbage, cauliflower and knol-khol caused by *Pythium apanidermatum* (Eds.) Fitz. *Ibid.*, **19**: 67.

———. 1950 *c*. Cercospora leaf-spot on *Schrebera swietenioides* Roxb. *Ibid.*, **19**: 292.

MALIK, R. P. 1945. Collar rot of pigeon pea caused by *Pythium apanidermatum* (Edson) Fitz. *Indian J. agric. Sci.*, **15**: 92–93.

MALIK, S. A. AND KHAN, M. A. 1943. Parasitic fungi of the North-West Frontier Province. *Ibid.*, **13**: 522–27.

MALLIK, S. A. 1935. A disease of the mango plants due to *Glœosporium* sp. *Proc. 22nd Indian Sci. Congr.* : 254.

MANN, H. H. AND NAGPURKAR, S. D. 1921. The ring disease of potato. *Bull. Dep. Agric. Bombay*, **102**: 38–57.

MARUDARAJAN, D. 1941. Observations on the production of sexual organs in paired cultures of *Phytophthora* species of the Palmivora group. *Proc. Indian Acad. Sci.*, **14 B**: 384–89.

——, RAMAKRISHNAN, T. S., MENON, K. K. AND SRINIVASAN, K. V. 1950. Ergot production and improvement. *Ibid.*, **31 B**: 103–10.

——, —— AND SOUMINI, C. K. 1950. Wilt of *Casuarina*. *Curr. Sci.*, **19**: 63.

MATHUR, R. N. 1933. Leaf curl in *Zinnia elegans* at Dehra Dun. *Indian J. agric. Sci.*, **3**: 89–96.

MATHUR, R. S. 1936 *a*. Notes on the fungi of Lucknow. (i) On the Perithecial stage of *Sphærostilbe bambusæ* Pat. on *Bambusa indica*. *Proc. 23rd Indian Sci. Congr.*: 288.

———. 1936 *b*. Notes on the fungus flora of Lansdowne (Garhwal District, North-West Himalayas). *Ibid.*: 289.

———. 1936 *c*. On a rare lichen from Lansdowne. *Ibid.*, 289.

———. 1948. Basis of plant quarantines. *Indian Phytopath.*, **1**: 159–63.

———. 1951. Function of spore matrix in *Colletotrichum lindemuthianum*. *Ibid.*, **4**: 152–55.

——, BARNETT, H. L. AND LILLY, V. G. 1950. Sporulation of *Colletotrichum lindemuthianum* in culture. *Phytopathology*, **40**: 104–14.

——, LILLY, V. G. AND BARNETT, H. L. 1949. Partial vitamin deficiencies in four strains of *Colletotrichum lindemuthianum*. *Indian Phytopath.*, **2**: 160–65.

MAYES, W. 1905. On the occurrence of a parasitic fungus on *Pinus excelsa*. *Indian For.*, **31**: 369–72.

MCCANN, C. 1933. Termite fungi. *J. Bombay nat. Hist. Soc.*, **35**: 909–10.

———. 1949. Termite fungi. *Ibid.*, **46**: 739–40.

MCKERRAL, A. 1923. A note on *Fusarium* wilt of gram in Burma and measures taken to combat it. *Agric. J. India*, **18**: 608–13.

MCRAE, W. 1911. Soft-rot of ginger in the Rangpur District, Eastern Bengal. *Ibid.*, **6**: 139–46.

———. 1912. Rows of spots on the leaves of palmyra palms caused by the bud-rot fungus, *Pythium palmivorum* Butl. *Ibid.*, **7**: 272–78.

———. 1917. Notes on South Indian fungi. *Madras agric. Dep. Year Book*, 1917: 108–11.

———. 1918 *a*. *Phytophthora meadii* sp. nov. on *Hevea brasiliensis*. *Mem. Dep. Agric. India, Bot.*, **9**: 219–73.

———. 1918 *b*. A new species of *Phytophthora* parasitic on the para rubber tree. *J. Bombay nat. Hist. Soc.*, **25**: 760.

———. 1919. A disease of the para rubber tree caused by *Phytophthora meadii* McR. *Agric. J. India*, **14**: 566–77.

———. 1922 *a*. I. History of the operations against bud-rot of palms in South India. *Mem. Dep. Agric. India, Bot.*, **12**: 21–56.

———. 1922 *b*. II. Inoculation experiments with *Phytophthora palmivora* Butl. on *Borassus flabellifer* L. and *Cocos nucifera* L. *Ibid.*, **12**: 57–70.

McRae, W. 1923 *a*. The operations against bud-rot of palms in South India. *Proc. 10th Indian Sci. Congr.*: 188.

———. 1923 *b*. The operations against the bud-rot of palmyra palms on the east coast. *Agric. J. India*, **18**: 487–500.

———. 1933. New diseases reported during the year 1932. *Int. Bull. Pl. Prot.*, **7**: 79–80.

———. 1934. Foot-rot diseases of *Piper betle* L. in Bengal. *Indian J. agric. Sci.*, **4**: 585–617.

—— and Subramaniam, L. S. 1933. Effect of mosaic on tonnage of juice of sugarcane in Pusa. *Ibid.*, **3**: 870–80.

Mehrotra, B. S. 1948. The chondriome in the genus *Phytophthora*. *Proc. 35th Indian Sci. Congr.*, pt. III: 225.

———. 1949 *a*. The influence of available carbohydrates upon ammonia accumulation by *Penicillium notatum* Westl. *Curr. Sci.*, **18**: 446.

———. 1949 *b*. Physiological studies of the genus *Phytophthora*. *J. Indian bot. Soc.*, **28**: 108–24.

———. 1951. Effect of certain hormones on growth and reproduction of some species of *Phytophthora*. *Curr. Sci.*, **20**: 131–32.

———. 1953. The effect of the source of carbon on the assimilability of ammonium and nitrate nitrogen by *Phytophthora cacterum* (Let. et Cohn) Schroet. *Proc. 40th Indian Sci. Congr.*, pt. III: 72.

Mehta, K. C. 1922. On the mode of infection and perennation of the smut of doob (*Cynodon dactylon* Pers.). *J. Indian bot. Soc.*, **3**: 243–51.

———. 1924. Observations on the spore characters and histology of some physiological species of *Puccinia graminis*. *Proc. 11th Indian Sci. Congr.*: 138.

———. 1925. Yellow and brown rusts of wheat. A preliminary note on their annual recurrence. *Proc. 12th Indian Sci. Congr.*: 191.

———. 1927 *a*. A note on the morphological characters of two physiological species of *Puccinia graminis*. Pers. *Proc. 14th Indian Sci. Congr.*: 214.

———. 1927 *b*. A preliminary note on the infection histology of two physiological species of *Puccinia graminis* Pers. *Ibid.*: 214.

———. 1927 *c*. A note on the infection histology of *Puccinia triticina* (*Dispersa*) Eriks. and Houn. *Ibid.*: 214.

———. 1929. The annual recurrence of rusts on wheat in India. Presidential Address (Sect. Bot.). *Proc. 16th Indian Sci. Congr.* : 199–223.

———. 1930 *a*. Studies on "powdery mildews" and rusts of cereals and the means of combating them. *Proc. 17th Indian Sci. Congr.*: 55.

———. 1930 *b*. Dissemination of "powdery mildews" of cereals. *Ibid.*: 282.

———. 1930 *c*. Studies on the annual recurrence of "powdery mildews" of wheat and barley in India. I. *Agric. J. India*, **25**: 283–85.

———. 1931 *a*. Annual outbreaks of rusts on wheat and barley in the plains of India. *Indian J. agric. Sci.*, **1**: 297–301.

———. 1931 *b*. The cereal-rust problem in India. *Ibid.*, **1**: 302–05.

———. 1933. Rusts of wheat and barley in India. *Ibid.*, **3**: 939–66.

———. 1937. Dissemination of wheat rusts. *Proc. 24th Indian Sci. Congr.* : 259.

MEHTA, K. C. 1940. Further studies on cereal rusts in India. *Sci. Monog. Coun. agric. Res. India,* **14**: vii + 224.

———. 1941. The wheat rust problem of India. *Curr. Sci.,* **10**: 357–61.

MEHTA, P. R. 1935 *a*. Morphological and cultural studies of the genus *Acrothecium*. *Proc. 22nd Indian Sci. Congr.* : 252.

———. 1935 *b*. Morphological and cultural studies in the genera *Vermicularia*, *Colletotrichum* and *Glœosporium*. *Ibid.*: 252.

———. 1937. A fruit-rot of apples caused by a species of *Rhizopus*. *Curr. Sci.,* **6**: 58–59.

———. 1939. A fruit-rot of apples caused by a species of *Rhizopus*. *Indian J. agric. Sci.,* **9**: 711–18.

———. 1940. Stem-end rot and soft rot of pineapple in the United Provinces. *Curr. Sci.,* **9**: 330.

—— AND BOSE, S. K. 1946. A leaf-spot disease of 'Jowar' (*Sorghum vulgare* Pers.) hitherto unrecorded from India. *Ibid.,* **15**: 49.

—— AND ——. 1947. A leaf-spot disease of fig (*Ficus carica* L.) caused by *Cylindrocladium scoparium* MorG. *Indian J. agric. Sci.,* **18**: 219–22.

—— AND MUNDKUR, B. B. 1946. Some observations on the rust of gram (*Cicer arietinum* L.). *Ibid.,* **16**: 186–92.

——, SINGH, B. AND BOSE, S. K. 1946. Some new hosts of *Sclerotinia sclerotiorum* (Lib.) De Bary. *Curr. Sci.,* **15**: 171.

MENON, K. P. V. 1934. Studies in the physiology of parasitism: Comparison of enzymatic extracts obtained from various parasitic fungi. *Ann. Bot. Lond.,* **48**: 187–210.

——, NAIR, U. K. AND PANDALAI, K. M. 1940. The 'leaf rot' disease of coconut palms in Travancore and Cochin. *Proc. 27th Indian Sci. Congr.*, pt. III: 132.

MILLIGAN, S. 1907. Rust in the Punjab. 1906–07. *Agric. J. India,* **2**: 402–03.

MITRA, A. 1934 *a*. A study of certain Fusaria. *Proc. 21st Indian Sci. Congr.* : 297.

———. 1934 *b*. A study of certain Fusaria. *J. Indian bot. Soc.,* **13**: 255–68.

———. 1934 *c*. Apple rot caused by *Fusarium moniliforme* Sheldon. *Curr. Sci.,* **3**: 202.

———. 1935 *a*. Interesting fungi—I. *Proc. 22nd Indian Sci. Congr.*: 251–52.

———. 1935 *b*. Studies on the Indian aquatic fungi. *Ibid.*: 252.

———. 1935 *c*. Investigations on the wound parasitism of certain Fusaria. *Indian J. agric. Sci.,* **5**: 632–37.

MITRA, A. K. 1941 *a*. A mycelial fungus on living leaves of *Lindsaya cultrata*. *Curr. Sci.,* **10**: 83–84.

———. 1941 *b*. Downy mildew of *Setaria verticillata* Beauv. *Proc. 28th Indian Sci. Congr.*, pt. IV: 157.

———. 1943. A new ascomycetous fungus on *Selaginella*. *Curr. Sci.,* **12**: 329.

———. 1944. *Melanopsamma Ranjanii* sp. nov., a new parasite of *Selaginella*. *J. Indian bot. Soc.,* **23**: 158–63.

MITRA, M. 1921. Morphology and parasitism of *Acrothecium penniseti* sp. nov. (A new disease of *Pennisetum typhoideum*). *Mem. Dep. Agric. India, Bot.,* **11**: 57–74.

MITRA, M. 1923. *Helminthosporium* spp. on cereals and sugarcane in India. Part I. (Diseases of *Zea mays* and *sorghum vulgare* caused by species of *Helminthosporium.*) *Mem. Dep. Agric. India, Bot.*, **11**: 219-42.

———. 1927 *a*. Fruit-rot disease of cultivated Cucurbitaceæ caused by *Pythium aphanidermatum* (Eds.) Fitz. *Proc. 14th Indian Sci. Congr.* : 213.

———. 1927 *b*. Gall formation on the roots of mustard due to a smut (*Urocystis coralloides* Rostrup). *Ibid.*, 213.

———. 1928. Gall formation on the roots of mustard due to a smut (*Urocystis coralloides* Rostrup). *Agric. J. India*, **23**: 104-06.

———. 1929. *Phytophthora parasitica* Dast. causing "damping-off" disease of cotton seedlings and "fruit-rot" of guava in India. *Trans. Brit. mycol. Soc.*, **14**: 249-54.

———. 1930 *a*. A comparative study of species and strains of *Helminthosporium* on certain Indian cultivated crops. *Ibid.*, **15**: 254-93.

———. 1930 *b*. Effect of environmental factors on the growth of certain species and strains of *Helminthosporium*. *Proc. 17th Indian Sci. Congr.* : 282-83.

———. 1930 *c*. Saltation in the genus *Helminthosporium*. *Ibid.*: 283.

———. 1931 *a*. A new bunt on wheat in India. *Ann. appl. Biol.*, **18**: 178-79.

———. 1931 *b*. Saltation in the genus *Helminthosporium*. *Trans. Brit. mycol. Soc.*, **16**: 115-27.

———. 1934 *a*. A leaf-spot disease of wheat caused by *Helminthosporium triticirepentis* Died. *Indian J. agric. Sci.*, **4**: 692-700.

———. 1934 *b*. Wilt disease of *Crotalaria juncea* L. (Sann-hemp). *Ibid.*, **4**: 701-14.

———. 1935 *a*. Stinking smut (bunt) of wheat with special reference to *Tilletia indica* Mitra. *Ibid.*, **5**: 51-73.

———. 1935 *b*. A new blight disease of gram. *Proc. 22nd Indian Sci. Congr.* : 374.

———. 1937 *a*. Soil infection as a factor in the transmission of wheat bunt. *Proc. 24th Indian Sci. Congr.*, 374.

———. 1937 *b*. Effect of bunt (*Tilletia indica*) on wheat. *Ibid.*, 374.

———. 1937 *c*. An anthracnose disease of sann hemp. *Indian J. agric. Sci.*, **7**: 443-49.

———. 1937 *d*. Studies on the stinking smut or bunt of wheat in India. *Ibid.*, **7**: 459-78.

———. 1937 *e*. New plant diseases recorded in 1936. *Int. Bull. Pl. Prot.*, **11**: 85-87.

———. 1940. Phytopathology—Mycology. *Ann. Rev. biochem. Res. India*, **11**: 93-104.

MITRA, M. AND BOSE, R. D. 1935 *a*. *Helminthosporium* diseases of barley and their control. *Indian J. agric. Sci.*, **5**: 449-83.

—— AND ——. 1935 *b*. Varietal resistance in Pusa barleys to *Helminthosporium sativum* P.K. and B. and *H. teres* Sacc. *Proc. 22nd Indian Sci. Congr.* : 372-73.

—— AND KHESWALLA, K. F. 1935. The effect of temperature on the growth of *Fusarium vasinfectum* Atk. *Proc. Indian Acad. Sci.*, **2 B**: 495-99.

MITRA, M. AND MEHTA, P. R. 1934 *a*. The effect of hydrogen-ion concentration on the growth of *Helminthosporium nodulosum* B. et C. and *H. leucostylum* Drech. *Indian J. agric. Sci.*, **4**: 914–20.

—— AND ——. 1934 *b*. Diseases of *Eleusine coracana* Gaertn. and *E. ægyptiaca* Desf. caused by species of *Helminthosporium*. *Ibid.*, **4**: 943–75.

—— AND ——. 1938. Some leaf diseases of *Hevea brasiliensis* new to India. *Ibid.*, **8**: 185–88.

—— AND SUBRAMANIAM, L. S. 1928. Fruit-rot disease of cultivated Cucurbitaceæ caused by *Pythium aphanidermatum* (Eds.) Fitz. *Mem. Dep. Agric. India, Bot.*, **15**: 79–84.

MITTER, J. H. 1929 *a*. A comparative study of certain species included in the section Discolor of the genus *Fusarium*. *Proc. 16th Indian Sci. Congr.*: 231.

————. 1929 *b*. Studies in the genus *Fusarium*. VII. Saltation in the section Discolor. *Ann. Bot., Lond.*, **43**: 379–410.

————. 1935. Fungous plant pathology and mycology in India. Presidential address (Sect. Bot.). *Proc. 22nd Indian Sci. Congr.* : 221–45.

————. 1936. Some recent contributions to our knowledge of heterothallism in fungi. *J. Indian bot. Soc.*, **25**: 183–92.

—— AND MITRA, A. K. 1940. Occurrence of *Sclersopora graminicola* (Sacc.) Schroet. on *Setaria verticillata* Beauv. in Allahabad. *Curr. Sci.*, **9**: 461.

—— AND TANDON, R. N. 1929. A cultural study of two fungi found in an Indian Hill apple. *J. Indian bot. Soc.*, **8**: 212–18.

—— AND ——. 1930 *a*. The fungus flora of Allahabad. *Ibid.*, **9**: 190–98.

—— AND ——. 1930 *b*. A note on *Sclerospora graminicola* (Sacc.) Schroet. in Allahabad. *Ibid.*, **9**: 243.

—— AND ——. 1930 *c*. Fungus flora of Allahabad. Part VI. Proc. 17th Indian Sci. Congr.: 284.

—— AND ——. 1932. Fungus flora of Nainital. Part I. *J. Indian bot. Soc.*, **11**: 178–80.

—— AND ——. 1937 *a*. Fungi of Allahabad, India—III. *Proc. Indian Acad. Sci.*, **6 B**: 194–201.

—— AND ——. 1937 *b*. Fungi of Mussoorie. *Proc. nat. Acad. Sci., India*, **7**: 175–80.

—— AND ——. 1938. Fungi of Nainital. Part II. *J. Indian bot. Soc.*, **17**: 177–82.

MOHANTY, U. N. 1946. The wilt disease of pigeon pea [*Cajanus cajan* (L.) Millsp., with special reference to the distribution of the causal organism in the host tissue]. *Indian J. agric. Sci.*, **16**: 379–90.

————. 1948. Studies in Indian Aspergilli. *Indian Phytopath.*, **1**: 55–66.

MOHENDRA, K. R. 1928 *a*. Variation in *Sphæropsis malorum*. *Proc. 15th Indian Sci. Congr.*: 235.

————. 1928 *b*. A study of changes undergone by certain fungi in artificial culture with special reference to the occurrence of saltation. *Ibid.*: 235–36.

————. 1928 *c*. A study of the changes undergone by certain fungi in artificial cultures. *Ann. Bot., Lond.*, **42**: 863–89.

————. 1930. A simplified method of hot water treatment against loose smut of wheat. *Proc. 17th Indian Sci. Congr.* : 56.

MOHENDRA, K. R. AND MITRA, M. 1930. On the cultural behaviour of *Sphæropsis malorum* P.K. *Ann. Bot., Lond.*, **44**: 541–55.

MONTAGUE, C. 1842. Cryptogamæ Nilgherriensis sen Plantarum cellularium in montibus peninsulæ indicæ Neelgherries dictis a cl. Perottet collectarum enumeratio. *Ann. Sci. nat. (Bot.)*, **17**: 17–21.

MOORTHY, B. R., DESAI, S. V. AND SAMUEL, C. K. 1948. Preliminary studies on a chemical and physico-chemical control of the leaf curl disease of tobacco. *Proc. 35th Indian Sci. Congr.*, Pt. III: 121–22.

MOREAU, F. 1951. Un champignon lichenicole cecidogene *Phyllosticta galligena* sp. nov. *Bull. Soc. bot. Fr.*, **98**: 100–02.

MOREAU, M. *et* MME. FERNAND. 1952. Lichens de l' Inde. *Rev. bryol. lichen.*, **21**: 135–43.

MOSES, S. T. 1948. A prelimihary report on the mushrooms of Baroda. *Proc. 35th Indian Sci. Congr.*, Pt. III: 217.

MUDALIAR, S. R. V. 1922. A historical account of South Indian fungi with special reference to those of Coimbatore. *Proc. 9th Indian Sci. Congr.* : 32.

MUKERJI, B. AND DE, N. K. 1944. A method for the assay of individual *Ergot sclerotium*. *Curr. Sci.*, **13**: 128.

MULLER, A. J. 1892. Lichenes Manipurensis, a cl. Dr. G. Watt, erica Manipur, ad limite Orientales Indiæ Orientales. *J. Linn. Soc. (Bot.)*, **29**: 217–31.

MUNDKUR, B. B. 1928. Importance of iron for the growth of fungi (*Fusarium vasinfectum* Atkinson). *Proc. 15th Indian Sci. Congr.*: 230.

———. 1934 *a*. A Sclerotinia-rot of *Hibiscus sabdariffa* L. *Indian J. agric. Sci.*, **4**: 753–78.

———. 1934 *b*. Perfect stage of *Sclerotium rolfsii* Sacc. in culture. *Ibid.*, **4**: 779–81.

———. 1934 *c*. Oat smut in India. *Ibid.*, **4**: 895–98.

———. 1935 *a*. The parasitism of *Sclerotium oryzæ* Catt. *Proc. 22nd Indian Sci. Congr.* : 373.

———. 1935 *b*. Parasitism of *Sclerotium oryzæ* Catt. *Indian J. agric. Sci.*, **5**: 393–414.

———. 1935 *c*. Influence of temperature and maturity on the incidence of sann-hemp and pigeon pea wilt at Pusa. *Ibid.*, **5**: 609–18.

———. 1935 *d*. Oat leaf infection by *Ustilago avenæ* (Pers.) Jensen. *Ibid.*, **5**: 745–46.

———. 1936 *a*. On the systematic position of the smut causing malformation of *Vitis quadrangularis*. *Ibid.*, **6**: 876–77.

———. 1936 *b*. A *Rhizoctonia* on sweet potatoes in Bombay. *Ibid.*, **6**: 994–95.

———. 1936 *c*. Resistance of American cottons to *Fusarium* wilt in India. *Proc. Indian Acad. Sci.*, **3 B**: 498–501.

———. 1938 *a*. Host range and identity of the smut causing root-galls in the genus *Brassica*. *Proc. 25th Indian Sci. Congr.*, Pt. III: 144.

———. 1938 *b*. Host range and identity of the smut causing root-galls in the genus *Brassica*. *Phytopathology*, **28**: 134–42.

———. 1938 *c*. *Urocystis sorosporioides*—a new record for India. *Trans. Brit. mycol. Soc.*, **21**: 240–42.

MUNDKUR, B. B. 1938 *d*. Fungi of India. Supplement I. Delhi. *Sci. Monog. Coun. agric. Res. India*, **12**: 1–54.

———. 1939 *a*. Taxonomic studies of Indian smuts. *Proc. 26th Indian Sci. Congr.*, Pt. III: 115.

———. 1939 *b*. A contribution towards a knowledge of Indian Ustilaginales. Fragments I-XXV. *Trans. Brit. mycol. Soc.*, **23**: 86–121.

———. 1940 *a*. A second contribution towards a knowledge of Indian Ustilaginales. Fragments XXVI-L. *Ibid.*, **24**: 312–36.

———. 1940 *b*. On *Corticium album* of Dastur. *Curr. Sci.*, **9**: 285.

———. 1943 *a*. Karnal bunt, an air-borne disease. *Ibid.*, **12**: 230–31.

———. 1943 *b*. Studies in Indian cereal smuts. V. Mode of transmission of the Karnal bunt of wheat. *Indian J. agric. Sci.*, **13**: 54–58.

———. 1943 *c*. Studies in Indian cereal smuts. VI. The smuts on Sawan (*Echinochloa frumentacea*). *Ibid.*, **13**: 631–633.

———. 1943 *d*. Indian species of *Phakopsora* and *Bubakia*. *Mycologia*, **35**: 538–45.

———. 1944 *a*. Some rare and new smuts from India. *Indian J. agric. Sci.*, **14**: 49–52.

———. 1944 *b*. Fungi of the North-Western Himalayas—Ustilaginales. *Mycologia*, **36**: 286–93.

———. 1945. Studies in Indian cereal smuts. VIII. Nomenclature of Indian smut fungi and probable modes of their transmission. *Indian J. agric. Sci.*, **15**: 108–10.

———. 1947. Controlling plant diseases. *Indian Fmg.*, **8**: 175–77.

———. 1949. *Fungi and Plant Disease*. 246 pp. Macmillan & Co., Ltd., London.

———. 1951. Study of systematic mycology in India. Presidential Address (Sect. Bot.). *Proc. 38th Indian Sci. Congr.*, Pt. III: 155–68.

—— AND AHMAD, S. 1946. Revisions of and additions to Indian Fungi. II. *Mycol. Pap.*, **18**: 1–11.

—— AND KHAN, M. A. 1934. A dry spray method of treating oat seed against covered smut. *Indian J. agric. Sci.*, **4**: 899–905.

—— AND KHESWALLA, K. F. 1942. Indian and Burman species of the genera *Pestalotia* and *Monochætia*. *Mycologia*, **34**: 308–17.

—— AND ——. 1943. *Dasturella*—a new genus of Uredinales. *Ibid.*, **35**: 201–06.

—— AND KULKARNI, G. S. 1925. Parasitism of *Fusarium* which causes the wilt disease of cotton in the Bombay Presidency. *Proc. 12th Indian Sci. Congr.*: 192.

—— AND PAL, B. P. 1941. Studies in Indian cereal smuts. II. Varietal resistance of Indian and other wheats to loose smut. *Indian J. agric. Sci.*, **11**: 675–86.

——, PAL, B. P. AND PUSHKAR NATH. 1937. Relative susceptibility of some wild and cultivated potato varieties to an epidemic of late blight at Simla in 1936. *Ibid.*, **7**: 627–32.

—— AND PRASAD, N. 1938. On a new *Ravenelia* from India. *Proc. 25th Indian Sci. Congr.*, Pt. III: 144.

MUNDKUR, B. B. AND THIRUMALACHAR, M. J. 1943. *Catenulopsora*, a new genus of rusts. *Ann. Bot., Lond.*, N.S., **7**: 213–20.

—— AND ——. 1945. Two new genera of rusts on Bignoniaceæ. *Mycologia*, **37**: 619–28.

—— AND ——. 1946. Revision of and additions to Indian Fungi. I. *Mycol. Pap.*, **16**: 1–27.

—— AND ——. 1952. *Ustilaginales of India*. Kew, Commonwealth Mycological Institute, pp. 83.

MUNDKUR, B. D. 1949. Morphology and cytology of development of the sex organs of *Phytophthora himalayensis*. *Bot. Gaz.*, **110**: 475–86.

—— AND LINDEGREN, C. C. 1949. An analysis of the phenomenon of long-term adaptation to galactose by *Saccharomyces*. *Amer. J. Bot.*, **36**: 722–27.

MUNIYAPPA, Y., SUBRAMANIAM, K. AND SREENIVASAYA, M. 1941. Transmission of vinca spike to *Santalum album* and its significance. *Proc. 28th Indian Sci. Congr.*, Pt. III: 263.

MURDIA, M. S. 1938. Cytological studies on certain members of the *Saprolegniaceæ*. *J. Indian bot. Soc.*, **17**: 301–10.

———. 1939 *a*. Observations on the development of zoosporangium and liberation of zoospores in *Achlya dubia*. *Proc. nat. Acad. Sci., India*, **9**: 168–74.

———. 1939 *b*. Effect of B-Indolyl-3-Acetic Acid and Phenyl Acetic Acid on the growth of some members of the family Saprolegniaceæ. *Curr. Sci.*, **8**: 362–63.

MURRILL, W. A. 1924. Kashmir fungi. *Mycologia*, **16**: 133.

NAIDU, M. B. AND BAKSHI, V. M. 1946. The cytology of yeast. *Curr. Sci.*, **15**: 231.

NAIK, K. C. 1934. 'Am ka bagicha me eent ka bhatta'. *Kisan*, **4**: 240–42 (Hindi Monthly, Bihar).

NARASIMHAMOORTHY, N. AND SREENIVASAYA, M. 1929. Contributions to the study of spike disease of sandal. IV. Nitrogen metabolism in healthy and spiked leaves. *J. Indian Inst. Sci.*, **12**: 153–63.

NARASIMHAN, M. J. 1928 *a*. On some Phalloids collected in Mysore Province. *Proc. 15th Indian Sci. Congr.*: 235.

———. 1928 *b*. Note on the occurrence of intra-cellular bodies in spike disease of sandal. *Phytopathology*, **28**: 815–17.

———. 1930. Studies in the genus *Phytophthora* in Mysore. I. Heterothallic strains of *Phytophthora*. *Ibid.*, **20**: 201–14.

———. 1932. The Phalloideæ of Mysore. *J. Indian bot. Soc.*, **11**: 248–54.

———. 1933 *a*. Black rot of coffee. *Proc. 20th Indian Sci. Congr.* : 325.

———. 1933 *b*. Cytological investigations of the spike disease of sandal. *Phytopathology*, **23**: 191–202.

———. 1933 *c*. Black rot of coffee in Mysore. *Ibid.*, **23**: 875–66.

———. 1934. The beech bark disease. *Curr. Sci.*, **3**: 75.

———. 1952. Sclerotial disease of *Orobanche cernua* Loefel. *Proc. 39th Indian Sci. Congr.*, Pt. III: 36.

NARASIMHAN, M. J. AND THIRUMALACHAR, M. J. 1943. Preliminary note on the perfect stage of *Ephelis oryzæ* Syd. (*Balansia oryzæ* Syd.) comb. nov. *Curr. Sci.*, **12**: 276.

NARIANI, T. K. AND PATHANIAN, P. S. 1953. *Physalis peruviana*, a new host of tobacco leaf curl virus. *Indian Phytopath.*, **6**: 143–45.

—— AND SINGH, N. 1952. A mosaic disease of *Nicotiana glauca* R. Grah. *Ibid.*, **5**: 47–51.

NYLANDER, W. 1858–60. *Synopsis methodica Lichenum*, Paris, Martinet.

————. 1867 *a*. Synopsis Lichenum Novæ Caledoniæ. *Bull. Soc. linn. Normandie*, **2**: 139–40.

,————. 1867 *b*. Lichenes kurziani a Calcutta. *Flora*, **50**: 3–9.

————. 1869. Lichenes kurziani Bengaliense. *Ibid.*, **52**: 69–73.

————. 1900. Lichenes Ceylonenses et additamentum ad Lichens Japonicæ. *Acta. Soc. Sci. fenn.*, **26**: 1–33.

PADHI, B. 1953. Alternaria-like mutation of *Stemphylium*. *Proc. 40th Indian Sci. Congr.*, Pt. III: 72.

PADMANABHAN, S. Y. 1946. *Rhizoctonia* leaf-spot, a new leaf disease of sugarcane. *Curr. Sci.*, **15**: 353.

————. 1947. A new seedling disease of brinjals. *Indian J. agric. Sci.*, **18**: 393–95.

————. 1949. Occurrence of fungi inside rice kernels. *Curr. Sci.*, **18**: 442.

—— AND RAFAY, S. A. 1942. Two new reports of fungi on *Saccharum officinarum* and *S. arundinaceum*. *Ibid.*, **11**: 150.

——, ROY CHOUDHRY, K. R. AND GANGULY, D. D. 1948. *Helminthosporium* disease of rice. I. Nature and extent of damage caused by the disease. *Indian Phytopath.*, **1**: 34–47.

PADWICK, G. W. 1939. The genus *Fusarium*. I. Known occurrence in India. *Indian J. agric. Sci.*, **9**: 171–84.

————. 1940 *a*. The genus *Fusarium*. III. A critical study of the fungus causing wilt of gram (*Cicer arietinum* L.) and of the related species in the subsection *Orthocera*, with special relation to the variability of key characteristics. *Ibid.*, **10**: 241–84.

————. 1940 *b*. The genus *Fusarium*. V. *Fusarium udum* Butler, *F. vasinfectum* Atk. and *F. lateritium* Nees var. *uncinatum* Wr. *Ibid.*, **10**: 863–78.

————. 1940 *c*. A new disease of wheat in India. *Curr. Sci.*, **9**: 179.

————. 1940 *d*. Report of the Imperial Mycologist. *Sci. Rep. agric. Res. Inst., New Delhi*, 1938–39: 105.

————. 1941. The use of field observation in classifying Fungi Imperfecti. *Proc. nat. Acad. Sci. India*, **11**: 74–84.

————. 1944. Baluchistan sulphur for plant diseases. *Indian Fmg.*, **5**: 518–19.

————. 1945. Notes on Indian fungi. III. *Mycol. Pap.*, **12**: 1–15.

————. 1946. Notes on Indian fungi. IV. *Ibid.*, **17**: 1–12.

—— AND AZMATULLAH, M. 1943. *Claviceps purpurea* (Fr.) Tul. and a new species from Simla. *Curr. Sci.*, **12**: 257.

—— AND BHAGWAGAR, P. R. 1943. Wilt of gram in relation to date of sowing. *Indian J. agric. Sci.*, **13**: 289–90.

PADWICK, G. W. AND GANGULY, D. 1945. Stackburn disease of rice in Bengal. *Curr. Sci.*, **14**: 328.

—— AND KHAN, A. 1944. Notes on Indian fungi. II. *Mycol. Pap.*, **10**: 1–17.

—— AND MERH, J. L. 1943. Notes on Indian fungi. I. *Ibid.*, **7**: 1–7.

——, MITRA, M. AND MEHTA, P. R. 1940. The genus *Fusarium*. IV. Infection and cross-infection tests with isolates from cotton (*Gossypium* sp.), pigeon-pea (*Cajanus cajan*) and sann-hemp (*Crotalaria juncea*). *Indian J. agric. Sci.*, **10**: 707–15.

—— AND UPPAL, B. N. 1940. The problem of inter-provincial plant quarantines in India. *Ibid.*, **10**: 697–706.

PAL, B. P. 1936 *a*. Effects of brown-rust attack on wheat. *Ibid.*, **6**: 127–28.

————. 1936 *b*. A note on the relation between the internal stem structure of certain varieties of gram (*Cicer arietinum* L.) and their resistance to cutworm attack. *Proc. Indian Acad. Sci.*, **3 B**, 527–34.

————. 1937. Leaf curl of tobacco in North India. *Proc. 24th Indian Sci. Congr.* : 372.

————. 1943. Virus diseases of potatoes in India. *Curr. Sci.*, **12**: 279.

————. 1948. The control of wheat rust by breeding. *J. Indian bot. Soc.*, **27**: 169–84.

—— AND MUNDKUR, B. B. 1939. Studies in Indian cereal smuts. I. Cereal smuts and their control by the development of resistant varieties. *Proc. Indian Acad. Sci.*, **9 B**: 267–70

—— AND ——. 1945. Studies in Indian cereal smuts. VII. Further studies in varietal resistance of Indian and other wheats to loose smuts. *Indian J. agric. Sci.*, **15**: 106–08.

—— AND PUSHKAR NATH. 1935. Phyllody—a possible virus disease of *Sesamum*. *Ibid.*, **5**: 517–22.

—— AND TANDON, R. K. 1937. Types of tobacco leaf curl in Northern India. *Ibid.*, **7**: 363–93.

PAL, N. L., CHATTERJI, U. N. AND RANJAN, S. 1937. Effect of gases from brick-kilns on mango crops. *Proc. 24th Indian Sci. Congr.* : 270–71.

PANT, D. N. 1950. On the occurrence of a genus of Fungi Imperfecti, *Blastotrichum* Corda in India. *Indian Phytopath.*, **3**: 179–81.

————. 1951. Genus *Helicoceras* Linder, newly reported from India. *Curr. Sci.*, **20**: 212.

PARACER, C. S. AND LUTHRA, J. C. 1944. Further studies on the stem rot disease of rice caused by *Sclerotium oryzæ* Catt. in the Punjab. *Indian J. agric. Sci.*, **14**: 44.

PARANDEKAR, S. A. 1933. *Puccinia helianthi* (Schw.) Syd., a rust fungus on the sunflower (*Helianthus annuus*). *J. Bombay nat. Hist. Soc.*, **35**: 916–17.

————. 1937. A note on the uredo on *Jasminum malabaricum* Wight. *J. Indian bot. Soc.*, **16**: 307.

—— AND AJREKAR, S. L. 1932. Observations on *Puccinia Thwaitesii* Berk. *Ibid.*, **11**: 127–31.

PARK, M. 1932. *Tuber zeylanicum* B. & Br. and *Sclerotium rolfsii* Sacc. *Trans. Brit. mycol. Soc.*, **17**: 179–81.

PATEL, A. F. 1936. Root study of susceptible and resistant cotton to root-rot in Gujerat. *Proc. 23rd Indian Sci. Congr.* : 437.

PATEL, J. S. AND BALAKRISHNAN NAYAR, A. P. 1936. Natural and induced resistance to shoot-rot in the coconut. *Proc. Indian Acad. Sci.*, **3 B**: 432–37.

PATEL, M. K. 1926. An improved method of isolating *Pseudomonas tumefaciens*. *Phytopathology*, **16**: 577.

———. 1929 *a*. Biological studies of *Pseudomonas tumefaciens*. Sm. & Town. and fifteen related non-pathogenic organisms. *Iowa St. Coll. J. Sci.*, **2**: 271–98.

———. 1929 *b*. Viability of certain plant pathogens in soils. *Phytopathology*, **19**: 295–300.

———. 1948 *a*. A new bacterial disease of *Ipomœa muricata*. *Curr. Sci.*, **17**: 245.

———. 1948 *b*. *Xanthomonas uppalii* sp. nov. pathogenic on *Ipomœa muricata*. *Indian Phytopath.*, **1**: 67–69.

———. 1948 *c*. *Bremia* sp. on *Arthraxon lancifolius* Hoch. in India. *Ibid.*, **1**: 104–06.

———. 1949 *a*. Production of oospores by *Sclerospora sorghi* on maize. *Curr. Sci.*, **18**: 83.

———. 1949 *b*. Production of oospores by *Sclerospora sorghi* on maize. *Indian Phytopath.*, **2**: 52–57.

———. 1949 *c*. Bacterial leaf-spot of *Desmodium diffusum* D.C. (*Xanthomonas desmodii* Uppal and Patel sp. nov.). *Ibid.*, **2**: 168–72.

——, ABHYANKAR, S. G. AND KULKARNI, Y. S. 1949. Black rot of cabbage. *Ibid.*, **2**: 58–61.

——, BHATT, V. V. AND KULKARNI, Y. S. 1951 *a*. Three new bacterial diseases of plants. *Curr. Sci.*, **20**: 326–27.

——, —— AND ——. 1951 *b*. Three new bacterial diseases of plants from Bombay. *Indian Phytopath.*, **4**: 144–51.

——, DHANDE, G. W. AND KULKARNI, Y. S. 1950. A modified treatment against loose smut of wheat. *Curr. Sci.*, **19**: 324.

——, —— AND ——. 1951. Studies in some species of *Xanthomonas*. *Indian Phytopath.*, **4**: 123–40.

—— AND DIWAN, N. D. 1950. Bacterial blight of cowpea. *Ibid.*, **3**: 75–80.

——, GOKHALE, V. P. AND KULKARNI, N. B. 1951. Additions to fungi of Bombay. 1. *Ibid.*, **4**: 64–66.

——, KAMAT, M. N. AND BHIDE, V. P. 1949. Fungi of Bombay. Supplement I. *Ibid.*, **2**: 142–55.

——,—— KULKARNI, N. B. AND DESAI, M. K. 1950. Occurrence of green ear stage in sorghum. *Curr. Sci.*, **19**: 156.

——,——, AND PADHYE, Y. A. 1950. A new record of *Puccinia* on sugarcane in Bombay. *Ibid.*, **19**: 121.

——, KULKARNI, N. B. AND GAIKWAD, S. R. 1950. Staining bacterial flagella. *Ibid.*, **19**, 322–23.

——,——, AND KULKARNI, Y. S. 1952. Ring disease of potato in India. *Ibid.*, **21**: 47.

PATEL, M. K. AND KULKARNI, Y. S. 1948. *Xanthomonas malvacearum* (Sm.) Dowson on exotic cottons in India. *Curr. Sci.*, **17**: 243–44.

—— AND ——. 1949. Nitrogen utilization by *Xanthomonas malvacearum* (Sm.) Dowson. *Indian Phytopath.*, **2**: 62–64.

—— AND ——. 1950. Bacterial leaf-spot of cotton. *Ibid.*, **3**: 51–63.

—— AND——. 1951 *a*. Nomenclature of bacterial plant pathogens. *Ibid.*, **4**: 74–84.

—— AND ——. 1951 *b*. A new bacterial leaf-spot of *Vitis woodrowii* Stapf. *Curr. Sci.*, **20**: 132.

—— AND ——. 1953. A review of bacterial plant disease investigations in India. *Indian Phytopath.*, **6**: 131–40.

——, —— AND DHANDE, G. W. 1949 *a*. A new *Synchytrium* on *Phaseolus mungo*. *Curr. Sci.*, **18**: 171.

——, —— AND ——. 1949 *b*. Bacterial leaf-spot of lucerne. *Indian Phytopath.*, **2**: 166–67.

——, —— AND ——. 1950 *a*. Bacterial leaf-spot of chillies. *Ibid.*, **3**: 95–97.

——, —— AND ——. 1950 *b*. *Xanthomonas badrii on Xanthium strumarium*. *Ibid.*, **3**: 103–04.

——, —— AND ——. 1951 *a*. Bacterial leaf-spot of castor. *Curr. Sci.*, **20**: 20.

——, —— AND ——. 1951 *b*. Three bacterial diseases of plants. *Ibid.*, **20**: 106.

——, —— AND ——. 1952. Two new bacterial diseases of plants. *Ibid.*, **21**: 71–72.

——,—— AND MONIZ, L. 1948. *Pseudomonas mangiferæ-indicæ*, pathogenic on mango. *Indian Phytopath.*, **1**: 147–52.

—— AND MONIZ, L. 1948 *a*. *X. desmodii-gangeticii* sp. nov. Uppal, Patel and Moniz, a new bacterial leaf-spot of *Desmodium gangeticum* D.C. *Curr. Sci.*, **17**: 268.

—— AND ——. 1948 *b*. Bacterial leaf-spot of *Desmodium gangeticum* D.C. *Indian Phytopath.*, **1**: 137–41.

—— AND KULKARNI, Y. S. 1948. A new bacterial disease of *Mangifera indica*. *Curr. Sci.*, **17**: 189–90.

—— AND PADHYE, Y. A. 1948. Bacterial soft-rot of mango. *Indian Phytopath.*, **1**: 127–28.

——, PAYAK, M. M. AND KULKARNI, N. B. 1951. Additions to fungi of Bombay. II. *Ibid.*, **4**: 71–73.

——, QURESHI, I. M. AND BHIDE, V. P. 1949. First record of *Verticillium* wilt in India. *Ibid.*, **2**: 245–46.

PATWARDHAN, G. B. 1928. Field, garden and orchard crops of Bombay Presidency. *Bull. Dep. Agric. Bombay*, **30**.

PAULSON, R. 1925. Lichens of Mount Everest. *J. Bot., Lond.*, **63**: 189–93.

PAVGI, M. S. AND MUNDKUR, B. B. 1948. A third contribution towards a knowledge of Indian Ustilaginales. *Indian Phytopath.*, **1**: 107–18.

——, PITHAWALA, H. R., SAVUR, G. R. AND SREENIVASAN, A. 1951. Polygalacturonase activity of *Aspergilli*. *Proc. Indian Acad. Sci.*, **34 B**: 33–42.

—— AND THIRUMALACHAR, M. J. 1951. Notes on some Indian Ustilagineæ. III. *Sydowia*, **5**: 9–12.

—— AND ——. 1952. Notes on Indian Ustilagineæ. IV. *Mycologia*, **44**: 318–24.

PAWAR, M. S. AND KULKARNI, S. A. 1954. *Piricularia* sp. on *Setaria intermedia* Roem. and Schult. *Curr. Sci.*, **23**: 229–30.

PAYAK, M. M. 1949. Some parasitic fungi collected in the vicinity of Banaras. *Indian Phytopath.*, **2**: 190–93.

———. 1951. A *Synchytrium* disease of udid beans. *Curr. Sci.*, **20**: 103.

PETCH, T. 1908. The genus *Endocalyx* Berkeley and Broome. *Ann. Bot., Lond.*, **22**: 389–400.

———. 1924–26. Studies in entomogenous fungi. IV. Some Ceylon *Cordyceps*. *Trans. Brit. mycol. Soc.*, **10**: 28–45.

———. 1930. Revisions of Ceylon fungi Part IX. *Ibid.*, **15**: 247–54.

———. 1948. A revision of Ceylon Marasmii. *Ibid.* **31**: 19–44.

—— AND BISBY, G. R. 1950. *The Fungi of Ceylon.* Peradeniya Manual, No. VI. Ceylon Govt. Press, pp. 111.

PRAHLADA RAO, L. S. AND SUBRAMANIAM, M. K. 1953. Studies on the cytology of yeasts. VII. Nuclear phenomenon in cells from 24-hour agar slants. *Proc. Indian Acad. Sci.*, **37 B**: 72–81.

PRASAD, H. H. 1930. A bacterial soft rot of maize. *Agric. J. India*, **25**: 72.

———. 1931 *a*. A note on bacterial leaf-spot of Khira (*Cucumis sativus*). *Indian J. agric. Sci.*, **1**: 289–90.

———. 1931 *b*. A bacterial white soft-rot of turnip. *Ibid.*, **1**: 534–37.

———. 1938. A note on soft-rot of pears caused by a species of *Aspergillus*. *Ibid.*, **8**: 549–51.

PRASAD, N. 1944. Studies on the root-rot of cotton in Sind. I. *Ibid.*, **14**: 40–43.

———. 1949. Variability of the cucurbit root-rot fungus. *Fusarium* (*Hypomyces. solani* f. *cucurbitæ*). *Phytopathology*, **39**: 133–41.

———. 1952. Fire blight of *Cosmos*. A bacterial disease iniciated by *Erwinia cosmovora* sp. nov. *Curr. Sci.*, **21**: 17.

—— AND PADWICK, G. W. 1939. The genus *Fusarium*. II. A species of *Fusarium* as a cause of wilt of gram (*Cicer arietinum*). *Indian J. agric. Sci.*, **9**: 371–80.

—— AND PATEL, I. M. 1952. Chitri disease of tobacco in Gujerat. *Proc. 39th Indian Sci. Congr.*, Pt. III: 37.

PRASADA, R. 1940. Accidial stage of the rust of linseed. *Curr. Sci.*, **9**: 328–29.

———. 1946. The uredo-stage of *Aecidium* found on *Thalictrum* in the Simla hills. *Ibid.*, **15**: 254.

———. 1947 *a* Aecidial studies of linseed, *Melampsora lini* (Pers.) Lev. *Proc. 34th Indian Sci. Congr.*, Pt. III: 160–61.

———. 1947 *b*. The rust of safflower *Puccinia carthami* (Hutz.) Corda. *Curr. Sci.*, **16**: 292.

———. 1947 *c*. Reactions of certain varieties of *Hordeum* to Indian physiologic races of *Puccinia triticina* Erikss. *J. Indian bot. Soc.*, **26**: 213–19.

———. 1947 *d*. Discovery of the uredo-stage connected with the æcidia so commonly found on species of *Berberis* in the Simla hills. *Indian J. agric. Sci.*, **17**: 137–50.

———. 1948 *a*. Studies on rusts of some of the wild grasses occurring in the neighbourhood of Simla. *Ibid.*, **18**: 165–76.

PRASADA R. 1948 *b*. Studies in the formation and germination of teliospores of rusts. I. *Indian Phytopath.*, **1**: 119–26.

———. 1948 *c*. Studies in linseed rust, *Melampsora lini* (Pers.) Lev. *Ibid.*, **1**: 1–18.

———. 1948 *d*. *Darluca filum* (Biv.) Cast., a hyperparasite of *Puccinia graminis* and *Puccinia triticina* in the green house. *Curr. Sci.*, **17**: 215.

———. 1951. Rusts on wild grasses. *Ibid.*, **20**: 243.

—— AND GOSWAMI, T. K. 1950. Studies on clover rust, *Uromyces trifolii* (Hedw. f.) Lev. in India. *Indian Phytopath.*, **3**: 191–95.

—— AND TANDON, I. N. 1950. Leaf-spot disease of oats and its control. *Ibid.*, **3**: 87–94.

—— AND VERMA, U. N. 1948. Studies on lentil rust, *Uromyces fabæ* (Pers.) de Bary in India. *Ibid.*, **1**: 142–46.

PRUTHI, H. S. 1944. Leaf-curl disease of tobacco in India. *Indian Fmg.*, **5**: 220–23.

———. 1949. Treat your cereal seeds and control many serious diseases. *Indian Fmg.*, **10**: 477–80.

—— AND SAMUEL, C. K. 1937. Entomological studies on leaf curl disease of tobacco in North India. *Indian J. agric. Sci.*, **7**: 659.

—— AND ——. 1939. Entomological investigations on leaf curl disease of tobacco. *Ibid.*, **9**: 223.

—— AND ——. 1941. Entomological investigations on leaf curl disease of tobacco. *Ibid.*, **11**: 387.

—— AMD ——. 1942. Entomological investigations on leaf curl disease of tobacco. V. Biology and population of white fly vector (*Bemisia tabœi*) in relation to the incidence of disease. *Ibid.*, **17**: 35–57.

PUSHKAR NATH. 1933 *a*. Diseases of Kashmir apples. *Proc. 20th Indian Sci. Congr.* : 305.

———. 1933 *b*. On *Sclerotium oryzæ*—a sclerotial disease of the rice in the Punjab. *Ibid.*, 305.

———. 1949. Virus diseases of Indian potatoes. *Proc. 36th Indian Sci. Congr.*, Pt. III: 201.

———. 1952. *Solanum jasminoides* Virus. *Curr. Sci.*, **21**: 249.

—— AND PADWICK, G. W. 1941. Ergot in India. *Ibid.*, **10**: 488–89.

QURAISHI, A. A. 1928. Lichens of the Western Himalayas. *Proc. 15th Indian Sci. Congr.*: 228.

QURAISHI, A. R. 1937. Leaf-spot disease of *Camellia japonica*, due to *Alternaria* sp. *Proc. 24th Indian Sci. Congr.* : 261.

RAFAY, S. A. 1935. Physical properties of sugarcane mosaic virus. *Indian J. agric. Sci.*, **5**: 663–70.

———. 1950. Another strain of *Physalospora tucumanensis*. *Curr. Sci.*, **19**: 385.

———. 1952. Wilt disease of cane. *Proc. 39th Indian Sci. Congr.*, Pt. III: 307.

——AND PADMANABHAN, S.Y. 1940. Sugarcane smut in Bihar. *Curr. Sci.*, **9** : 496–97.

—— AND ——. 1941. Strains of *Colletotrichum falcatum* Went. *Ibid.*, **10**: 25–26.

RAFAY, S. AND PADMANABHAN, S. Y. 1947. Variations in *Colletotrichum falcatum* Went. *Proc. 34th Indian Sci. Congr.*, Pt. III: 228.

—, —— AND KHANNA, K. L. 1942. Control of the sugarcane seedling disease and nematode injury. *Proc. 29th Indian Sci. Congr.*, Pt. III: 218.

RAGHUNATHAN, C. 1928. Bacterial leaf-spot of *Piper betle*. *Ann. R. bot. Gdns. Peradeniya*, **11**: 51–61.

RAHMAN, K. A. 1942. Legislation against plant pests and diseases. *Indian Fmg.*, **3**: 269–72.

RAHMAN, S. M. A. 1951. Observation on the diseases of tezpata. *Curr. Sci.*, **20**: 135.

RAJAN, B. S. V., NIGAM, S. S. AND SHUKLA, R. K. 1952. A study of the atmospheric fungal flora at Kanpur. *Proc. Indian Acad. Sci.*, **35 B**: 33–37.

—— AND PATEL, J. S. 1946. Seed transmission of stem-rot of jute and its control. *Indian J. agric. Sci.*, **16**: 193–206.

RAMAKRISHNAN, K. 1949. Investigations on cereal rusts. II. *Uromyces setariæitalicæ* (Diet) Yoshind. *Indian Phytopath.*, **2**: 31–34.

—— AND RAMAKRISHNAN, T. S. 1948. Banded leaf blight of arrowroot, *Maranta arundinacea*. *Ibid.*, **1**: 129–36.

—— AND SUBRAMANIAN, C. V. 1952. The fungi of India—A second supplement. *J. Madras Univ.*, **22 B**: 165; 163–82.

RAMAKRISHNAN, T. S. 1927. Observations on *Thielaviopsis paradoxa*. *Proc. 14th Indian Sci. Congr.* : 212.

————. 1929 *a*. A wilt of *Zinnia* caused by *Sclerotium rolfsii*. *Proc. 16th Indian Sci. Congr.* : 228.

————. 1929 *b*. A leaf-spot disease of *Andropogon sorghum* caused by *Cercospora sorghi* E. and E. *Mem. Dep. Agric. India, Bot.*, **18**: 259–77.

————. 1940. Studies on the parasitism of *Colletotrichum indicum* Dast. *Proc. 27th Indian Sci. Congr.*, Pt. III: 229.

————. 1941 *a*. Foot-rot of sugarcane. *Curr. Sci.*, **10** : 354.

————. 1941 *b*. Top-rot ('Twisted top') or ('Pokkah Bong') of sugarcane, sorghum and cumbu. *Ibid.*, **10**: 406–08.

————. 1941 *c*. Studies on the parasitism of *Colletotrichum indicum* Dast. *Indian J. agric. Sci.*, **11**: 110–18.

————. 1941 *d*. Studies in the genus *Colletotrichum*. I. Saltation in *Colletotrichum capsici* (Syd.). *Proc. Indian Acad. Sci.*, **13 B**: 60–70.

————. 1941 *e*. Studies in the genus *Colletotrichum*. II. Physiological studies on *Colletotrichum falcatum* Went. *Ibid.*, **14 B**: 395–411.

————. 1942. A leaf-spot disease of *Zingiber officinale* caused by *Phyllosticta zingiberi* n. sp. *Ibid.*, **15 B**: 167–71.

————. 1947 *a*. Studies in the genus *Colletotrichum*. III. *Ibid.*, **25 B**: 15–27.

————. 1947 *b*. The natural occurrence of ergot in South India. III. *Ibid.*, **26 B**: 136–41.

————. 1948. Ergot Sclerotia on *Sorghum vulgare* Pers. *Curr. Sci.*, **17**: 218.

————. 1949 *a*. Studies in the genus *Colletotrichum*. IV. Leaf-spot of *Arundo donax* L. caused by *Colletotrichum falcatum* Went. var. *arundinis* var. nov. *Proc. Indian Acad. Sci.*, **29 B**: 289–94.

RAMAKRISHNAN, T. S. 1949 *b*. The occurrence of *Pythium vexans* de Bary in South India. *Indian Phytopath.*, **2**: 27–30.

———. 1950. Some interesting rusts of South India. *Ibid.*, **3**: 43–50.

———. 1951 *a*. Additions to fungi of Madras—X. *Proc. Indian Acad. Sci.*, **34 B**: 63–72.

———. 1951 *b*. Additions to fungi of Madras—XI. *Ibid.*, **34 B**: 157–64.

———. 1951 *c*. Two new rusts from South India. *Trans. Brit. mycol. Soc.*, **34**: 141–45.

———. 1952 *a*. Observations on ergots on *Pennisetum* and other grasses. *Proc. Indian Acad. Sci.*, **36 B**: 97–101.

———. 1952 *b*. Additions to fungi of Madras—XII. *Ibid.*, **35 B**: 111–21.

——— AND NARASIMHALU, I. L. 1941 *a*. A new host—*Ricinus communis*—for *Leveillula taurica* (Lev.) Arn. (*Oidiopsis taurica* (Lev.) Sahn.). *Curr. Sci.*, **10**: 211–12.

—— AND ——. 1941 *b*. The occurrence of *Darluca filum* (Biv.) Cast. on cereal rusts in South India. *Ibid.*, **10**: 290.

—— AND RAMAKRISHNAN, K. 1947 *a*. Additions to fungi of Madras—I. *Proc. Indian Acad. Sci.*, **25 B**: 28–34.

—— AND ——, 1947 *b*. Additions to the fungi of Madras—II. *Ibid.*, **25 B**: 178–87.

—— AND ——. 1947 *c*. Additions to fungi of Madras—III. *Ibid.*, **26 B**: 7–12.

—— AND ——. 1947 *d*. A new rust on *Dalbergia paniculata* Roxb. *Ibid.*, **26 B**: 60–63.

—— AND ——. 1947 *e*. Revision of a rust on *Oldenlandia* spp. *Ibid.*, **26 B**: 64–68.

—— AND ——. 1948 *a*. Additions to fungi of Madras—IV. *Ibid.*, **27 B**: 33–46.

—— AND ——. 1948 *b*. Additions to fungi of Madras—V. *Ibid.*, **28 B**: 56–70.

—— AND ——. 1949 *a*. Exobasidium from South India. *Ibid.*, **29 B**: 5–11.

—— AND ——. 1949 *b*. Additions to fungi of Madras—VI. *Ibid.*, **29 B**: 48–57.

—— AND ——. 1949 *c*. *Chaconia tectonæ* Ramakrishnan, T. S. and K. sp. nov. on teak. *Indian Phytopath.*, **2**: 17–19.

—— AND ——. 1950 *a*. Additions to fungi of Madras—VII. *Proc. Indian Acad. Sci.*, **32 B**: 67–79.

—— AND ——. 1950 *b*. Additions to fungi of Madras—VIII. *Ibid.*, **32 B**: 97–111.

—— AND ——. 1950 *c*. Additions to the fungi of Madras—IX. *Ibid.*, **32 B**: 205–14.

—— AND ——. 1950 *d*. Observations on the black-arm of cotton in Madras State. *Indian Phytopath.*, **3**: 64–74.

—— AND RANGASWAMI, G. 1948. *Uromyces acori* Ramakrishnan and Rangaswami sp. nov., on *Acorus calamus* L. *Curr. Sci.*, **17**: 240.

—— AND REDDY, G. S. 1949. Artificial infection of sorghum with long smuts. *Ibid.*, **18**: 418.

—— AND SOUMINI, C. K. 1946. *Hemileia Wrightiæ* Rac. on *Wrightia tinctoria* R. & Br. and *W. tomentosa* Roem. & Sch. *Ibid.*, **15**: 256.

—— AND ——. 1947 *a*. A new rust on *Premna tomentosa* Willd. *Proc. Indian Acad. Sci.*, **25 B**: 35–37.

RAMAKRISHNAN, T. S. AND SOUMINI, C. K.. 1947 *b*. Fruit-rot of tomatoes caused by *Phytophthora palmivora* Butl. *Ibid.*, **25 B**: 39–42.

—— AND ——. 1948 *a*. Wilt disease of *Pyrethrum*. *Indian Phytopath.*, **1**: 27–33.

—— AND ——. 1948 *b*. Studies in cereal rusts. I. *Puccinia penniseti* Zimm. and its alternate host. *Ibid.*, **1**: 97–103.

—— AND SRINIVASAN, K. V. 1950 *a*. On two new rust fungi. *Curr. Sci.*, **19**: 25–27.

—— AND ——. 1950 *b*. Two grass smuts. *Ibid.*, **19**: 216.

——,—— AND SUNDARAM, N. V. 1952. Additions to the fungi of Madras—XIII. *Proc. Indian Acad. Sci.*, **36 B**: 85–95.

—— AND SUBRAMANIAM, C. L. 1946. On *Catenulopsora zizyphi* on *Zizyphus oenoplea* Mill. *Curr. Sci.*, **15**: 261.

—— AND SUNDARAM, N. V. 1952. A new rust on *Antidesma* in India. *Trans. Brit. mycol Soc.*, **35**: 26–28.

RAMANATHA AYYAR, V. AND BALASUBRAMANIA IYER, R. 1936. A preliminary note on the mode of inheritance of reaction to wilt in *Cicer arietinum*. *Proc. Indian Acad. Sci.*, **3 B**: 438–43.

RAMIAH, K. AND RAMASWAMI, K. 1936. Breeding for resistance to *Piricularia oryzæ* in rice (*O. sativa*). *Ibid.*, **3 B**: 450–58.

RANGASWAMI, S. AND GRIFFITH, A. L. 1939 *a*. A note on control and eradication of new outbreaks of spike disease of sandal (*Santalum album*). *Indian For. Rec.* (*Silvicult.*), **3**: 263–90.

—— AND ——. 1939 *b*. Host plant and spike disease of sandal. *Indian For.*, **65**: 335.

—— AND ——. 1940. Entomological investigations on spike disease of sandal. *Indian For. Rec.*, **5**: 86–196.

—— AND SREENIVASAYA, M. 1935. Insect transmission of spike disease of sandal. *Curr. Sci.*, **4**: 17.

RANJAN, S. AND JHA, V. R. 1940. The effect of ethylene and sulphur dioxide on the fruits of *Mangifera indica*. *Proc. Indian Acad. Sci.*, **6 B**: 267–88.

RAO, D. A. R. AND SREENIVASAYA, M. 1928. Contributions to the study of spike-disease of sandal (*Santalum album*, Linn.). Part IV. Chemical composition of healthy and spiked sandal stems. *J. Indian Inst. Sci.*, **11**: 241–43.

RAO, Y. R. 1925. The "Pollu" disease of pepper. *Proc. 12th Indian Sci. Congr.*, 35.

RASANEN, V. 1951. Lichenes Novi VI. *Arch. Soc. zool. bot. fenn. Vanamo.*, **5**: 25–32.

———. 1952. Lichenes Novi. VII. *Ibid.*, **6**: 80–86.

RAU, Y. V. S. 1933. Contributions to the study of the physiology of spike disease of sandal. *J. Indian Inst. Sci.*, **16**: 169.

RAY, J. N. AND CHAUDHURI, H. 1934. A study of fungus causing loss of opium in storage. *Proc. 21st Indian Sci. Congr.* : 296.

RAYCHAUDHURI, S. P. 1942. Economic uses of fungi. *Sci. and Cult.*, **7**: 594–96.

———. 1946. Mode of infection of rice by *Ustilaginoidea virens* (Cke.). *J. Indian bot. Soc.*, **25**: 145–50.

———. 1947 *a*. A note on mosaic disease of sann-hemp and its crystallisation. *Curr. Sci.*, **16**: 26–28.

RAYCHAUDHURI, S. P. 1947 *b*. A mosaic disease of brinjals. *Curr. Sci.*, **16**: 149–50.

———. 1947 *c*. Saltation in *Helminthosporium oryzæ* B.R. De Haan. *Sci. and Cult.*, **13**: 77–78.

———. 1947 *d*. Further studies on *Diplodia cajani* Raychaudhuri. *J. Indian bot. Soc.*, **26**: 221–25.

———. 1948. Virus diseases of sann-hemp (*Crotalaria juncea*) in India. *Proc. 35th Indian Sci. Congr.* : Pt. III: 124.

———. 1949. *Oidiopsis gossypii* (Wakef.) Raychaudhuri f. *indica* f. nov. on cotton. *Trans. Brit. mycol. Soc.*, **32**: 288–90.

———. 1952 *a*. Bayberry yellows. *Phytopathology*, **42**: 17.

———. 1952 *b*. Retention of strains of tobacco mosaic virus in tomato seeds. *Ibid.*, **42**: 114.

———. 1952 *c*. Studies on internal browning of tomatoes. *Ibid.*, **42**: 591.

———. 1953 *a*. Studies on Bayberry yellows. *Ibid.*, **43**: 15.

———. 1953 *b*. Dilution curve of a ring spot strain of potato virus. X. *Amer. Potato J.*, **30**: 134–36.

—— AND JHA, A. 1954. Chilli mosaic occurring in Delhi. *Proc. 41st Indian Sci. Congr.*: pt. III: 256–57.

——, LAL, S. B. AND VASUDEVA, R. S. 1951. Further studies on cucumis virus 2 *c*. *Indian Phytopath.*, **3**: 182–90.

—— AND PATHANIAN, P. S. 1950. A mosaic disease of *Crotalaria mucronata*. *Curr. Sci.*, **19**: 213.

RHIND, D. 1927. Preliminary note on an internal boll disease of cotton in Burma. *Agric. J. India*, **22**: 34–38.

—— AND SETH, L. N. 1945. The fungi of Burma. *Indian J. agric. Sci.*, **15**: 142–54.

ROGERS, D. P. 1943. The genus *Pellicularia* (Thelephoraceæ). *Farlowia*, **1**: 95–118.

ROY, R. Y. 1951. A comparison of the mode of action of certain new chloronitrobenzene preparations with that of standard fungicides. *J. Indian bot. Soc.*, **30**: 148–80.

ROY, T. C. 1940. A preliminary study on orange fruit rot. *Curr. Sci.*, **9**: 349.

———. 1941. A root-rot disease of *Morus alba* Linn. *Proc. 28th Indian Sci. Congr.* : pt. III: 157.

———. 1951 *a*. Origin and development of views on virus diseases. *Sci. and Cult.*, **17**: 243.

———. 1951 *b*. Investigations on the effect of seed treatment of flax (*Linum usitatissimum* L.) in Bengal. *Indian Phytopath.*, **4**: 116–18.

ROYAN, S. AND SUBRAMANIAM, M. K. 1952. Critical evidence for somatic doubling of chromosomes in a top yeast. *Nature, Lond.*, **169**: 932.

RYAN, RUTH. 1928. *Asterina* spp. from India. *Mem. Dep. Agric. India, Bot.*, **15**: 103–05.

SADASIVAN, T. S. 1938. Competition in fungi. *Proc. 25th Indian Sci. Congr.*, Pt. III: 144–45.

SADASIVAN, T. S. 1939 *a*. Competition in fungi. I. A study of the growth relations of non-parasitic fungi in associated culture. *Proc. Indian Acad. Sci.*, **10 B**: 1–26.

———. 1939 *b*. Succession of fungi on decomposing wheat straw in different soils, with special reference to *Fusarium culmorum*. *Ann. appl. Biol.*, **26**: 497–508.

———. 1940. A quantitative study of the interaction of viruses in plants. *Ibid.*, **27**: 359–67.

———. 1950. Some aspects of soil-borne fungal diseases of plants. *The Palæobotanist*, **1**: 400–07.

———. 1951. Role of trace elements in control of root infecting fungi. *Proc. Indian Acad. Sci.*, **33 B**: 135–49.

—— AND SUBRAMANIAN, C. V. 1954. Recent advances in the study of soil-borne Fusaria. *J. Indian bot. Soc.*, **33**: 162–76.

SAFEEULLA, K. M. 1953. Morphological and cytological studies in *Albugo* spp. on *Ipomœa aquatica* and *Merremia emarginata*. *Proc. 40th Indian Sci. Congr.*, pt. III: 74.

SAHA, J. C. 1945. Studies in rots of Indian fruits. I. Occurrence of latent and superficial infections. *Indian J. agric. Sci.*, **15**: 332–38.

SAHNI, B. 1940. The Deccan traps: an episode of the tertiary era. Presidential Address. *Proc. 37th Indian Sci. Congr.*, pt. II: 1–21.

SAKSENA, K. L. 1930. Fungus flora of Allahabad. pt. I (revised). *Uromyces Andropogonis-annulati* Syd. et Butl. sp. nov. on a new host, *Andropogon pertusus* Willd. *Proc. 17th Indian Sci. Congr.*, 284.

SAKSENA, R. K. 1936 *a*. Recherches physiologiques et cytologiques sur quelques especes du geneve *Pythium*. *Rev. gén. Bot.*, **48**: 156–88.

———. 1936 *b*. Structure of the nucleus in the genus *Pythium*. *J. Indian bot. Soc.*, **25**: 345–48.

———. 1937. Sexual organs of *Pythium arrhenomanes* Drechsler. on artificial substrata. *Curr. Sci.*, **6**: 101–02.

———. 1939. Growth of *Pythium hyphalosticton* Sideris. in synthetic nutrient liquid media. *Ibid.*, **8**: 81–82.

———. 1940. The nutrition of some species of genus *Pythium* on synthetic liquid media. *Proc. nat. Acad. Sci. India*, **10**: 1–13.

———. 1941 *a*. Thiamin and growth of some species of *Pythium*. *Proc. Indian Acad. Sci.*, **14 B**: 141–48.

———. 1941 *b*. Importance of growth promoting substances in the metabolism of *Pythium indigoferæ* Butler. *J. Indian bot. Soc.*, **20**: 183–87.

———. 1953. Some aspects of phsyiology and cytology of *Pythiaceæ*. Presidential Address (Sect. Bot). *Proc. 40th Indian Sci. Congr.*, pt. II, 1–17.

—— AND BHARGAVA, K. S. 1941 *a*. A physiological study of *Saprolegnia delica* Coker. *Proc. nat. Acad. Sci. India*, **11**: 27–40.

—— AND ——. 1941 *b*. Some observations on the cytology of *Saprolegnia delica*. *Ibid.*, **11**: 60–66.

—— AND ——. 1943. Nitrogen requirements and vitamin deficiencies of *Phytophthora phaseoli* Thaxter. *Proc. Indian Acad. Sci.*, **18 B**: 45–51.

—— AND ——. 1944. A new variety of *Isoachlya anisospora* (de Bary) Coker. *Curr. Sci.*, **13**: 79.

SAKSENA, R. K. AND BHARGAVA, K. S. 1946. Some cytological observations on spore-formation in *Thraustotheca clavata*. *Mycologia*, **38**: 554–64.

—— AND DAYAL, D. 1943. The structure of the cilia of *Thraustotheca clavata* (de Bary) Hump. *J. Indian bot. Soc.*, **22**: 37–39.

——,——, VERMA, J. C. AND MEHROTRA, B. S. 1949. Observations on the vacuolar system of some lower fungi. *Proc. nat. Acad. Sci., India*, **19**: 49–63.

—— AND BOSE, S. K. 1944. The enzymes of two water moulds. *J. Indian bot. Soc.*, **23**: 108–12.

—— AND ——. 1945 *a*. Studies on the genus *Pythium*. I. Cytological studies. 3. The chondriome system. *Proc. 32nd Indian Sci. Congr.*, pt. III: 79.

—— AND ——. 1945 *b*. The action on vital dyes on *Achlya dubia* Coker. and *Thraustotheca clavata* (de Bary) Hump. *Ibid.*, Pt. III: 79–80.

—— AND ——. 1948. The chondriosome in the genus *Pythium*. *Indian Phytopath.*, **1**: 48–54.

—— AND DAYAL, D. 1945. Thiamin and growth of certain fungi. *Proc. nat. Acad. Sci. India*, **15**: 1–5.

—— AND JAFRI, S. M. H. 1950. Enzymes of some species of *Pythium*. *Ibid.*, **20**: 49–59.

—— AND JAIN, S. K. 1947 *a*. The influence of available carbohydrates on ammonia accumulation by *Pythium aphanidermatum* (Eds.) Fitz. *Proc. 34th Indian Sci. Congr.*, pt. III: 162.

———. 1947 *b*. Nitrogen requirements of the genus *Pythium*. *Ibid.*, pt. III: 162.

—— AND MEHROTRA, B. S. 1948. Carbon requirements of the genus *Pythium*. *Proc. 35th Indian Sci. Congr.*, pt. III: 225.

———. 1953. Fungus flora of Allahabad soils. *Proc. 40th Indian Sci. Congr.*, pt. III: 76.

—— AND VARMA, J. C. 1945 *a*. Studies on the genus *Pythium*. I. Cytological studies. 1. Action of vital dyes. *Proc. 32nd Indian Sci. Congr.*, pt. III: 78–79.

—— AND ——. 1945 *b*. Studies on the genus *Pythium*. I. Cytological studies. 2. The vacuolar system. *Ibid.*, Pt. III: 79.

—— AND ——. 1945 *c*. Studies on the genus *Pythium*. II. Physiological studies. I. Growth substances. *Proc. 32nd Indian Sci. Congr.*, pt. III: 83.

SAKSENA, S. B. 1953. A new genus of the Mucorales. *Mycologia*, **45**: 426–36.

—— AND MURTY, G. K. 1953. Some soil fungi from Saugor. *Proc. 40th Indian Sci. Congr.*, pt. III: 78.

SALAM, M. A. AND RAO, P. N. 1953. Occurrence of *Curvularia lunata* (Wakker) Boedijn. in discoloured rice seedlings and leaves in Hyderabad-Dn. *Ibid.*, pt. III: 74–75.

SALMON, E. S. 1907. Notes on some species of *Erysiphaceæ* from India. *Ann. mycol., Berl.*, **5**: 476–79.

SALUJA, R. C. 1941 *a*. Seasonal distribution and comparative study of Aspergilli isolated from atmosphere. *Proc. 28th Indian Sci. Congr.*, pt. III: 157.

———. 1941 *b*. A study of the Penicillia causing rots of animals and fruits. *Ibid.*, pt. III: 158.

SAMPATH, S. 1944. Effect of vanadium on yeast cells. *Curr. Sci.*, **13**: 47.

SAROJINI, T. S. (MISS). 1951. Soil conditions and root diseases. II. *Fusarium udum* disease of red gram. [*Cajanus cajan* (Linn.) Millsp.]. *Proc. Indian Acad. Sci.*, **33 B**: 49–68.

—— AND YOGESWARI, L. (MISS). 1947. Aeration affecting growth and sporulation of some soil Fusaria in liquid cultures. *Ibid.*, **26 B**: 69–76.

SASTRI, B. N. 1929. Note on the starch liquifying action of sandal leaf extract. *J. Indian Inst. Sci.*, **12**: 251.

————. 1936. Physiology of spike disease of sandal. *Proc. Indian Acad. Sci.*, **3 B**: 444–49.

—— AND NARAYANA, M. 1931. The spike disease of *Dodonæa viscosa*. *J. Indian Inst. Sci.*, **14**: 147–52.

—— AND SREENIVASAYA, M. 1929. Contributions to the study of spike disease of sandal. VII. Factors influencing diastatic acitivity. *Ibid.*, **12**: 233–38.

SATTAR, A. 1933 *a*. A comparative study of the fungi associated with blight diseases of certain cultivated leguminous plants. *Trans. Brit. mycol. Soc.*, **18**: 276–301.

————. 1933 *b*. On the occurrence, perpetuation and control of gram (*Cicer arietinum* L.) blight caused by *Aschochyta rabiei* (Pass.) Labrousse, with special reference to Indian conditions. *Ann. appl. Biol.*, **20**: 612–32.

————. 1939. Diseases of mango in the Punjab. *Punjab Fr. J.*, **3**: 517–19.

—— AND HAFIZ, A. 1943. Tuber rot disease and the potato seed problem in the Punjab. *Ibid.*, **7**: 1240–43.

————. 1952. Researches on plant diseases of the Punjab, Lahore. *Sci. Monog. Pakist. Ass. Adv. Sci.*, **1**: 158 pp.

—— AND MALIK, S. M. 1939. Some studies on anthracnose of mango caused by *Glomerella cingulata* Stonem (S. & V.S.) (*Colletotrichum gloeosporioides* Penz.) in the Punjab. *Indian J. agric. Sci.*, **9**: 511–21.

SATYANARAYANA, G. AND KALYANASUNDARAM, R. 1952. Soil conditions and root diseases. V. Symptomatology of wilted cotton and red gram. *Proc. Indian Acad. Sci.*, **36 B**: 54–58.

SAWHNEY, A. 1926. Studies in the biological and cultural characters of *Capnodium* sp. on cotton. *J. Indian bot. Soc.*, **5**: 141–86.

————. 1927. Studies in the biological and cultural characters of *Capnodium* on cotton. *Proc. 14th Indian Sci. Congr.*, 211.

SAWHNEY, C. L. 1937. Smuts of the Punjab. I. *Proc. 24th Indian Sci. Congr.* : 260.

SAXENA, B. N. 1954. *Rhizoctonia* rot of tomato fruits. *Proc. 41st Indian Sci. Congr.*, pt. III: 125.

SEN, J. 1926. A few parasitic fungi from Bengal. *Proc. 13th Indian Sci. Congr.* : 223.

————. 1949. On a new species of *Pucciniastrum* from India. *Proc. 36th Indian Sci. Congr.*, pt. IV: 126.

SEN, P. K. 1941. Black-tip of mango. *Sci. and Cult.*, **7**: 56.

————. 1942. Further studies on 'black-tip' of mango. *Ibid.*, **8**: 91–92.

————. 1943 *a*. Studies on 'black-tip' damage of mango. *Ibid.*, **9**: 343–45.

————. 1943 *b*. Black-tip disease of the mango. *Indian J. agric. Sci.*, **13**: 300–33.

————. 1943 *c*. Smoke nuisance in fruit orchards. *Indian Fmg.*, **4**: 291–94.

SEN, P. K., GANGULI, B. D. AND MALLICK, P. C. 1946. A note on leaf curl disease of papaya. *Indian J. Hort.*, **3**: 38–40.

——, MALLIK, P. C. AND ROY, P. K. 1943. Toxic effect of gases on plants. *Sci. and Cult.*, **9**: 87–88.

SEN, T. N. 1934. Collar swelling in areca palm. *Proc. 21st Indian Sci. Congr.*, 78.

SEN-GUPTA, S. K. 1943. Spore germination of *Ganoderma lucidum* (Leyss.) Karst. *Curr. Sci.*, **12**: 59–60.

SEN-GUPTA, S. R. 1932. *Polyporus zonalis* Berk. and its effect on bamboo. *Proc. 19th Indian Sci. Congr.* : 296.

SETH, L. N. 1934. Studies in the genera *Cytosporina*, *Phomopsis* and *Diaporthe*. V. Analysis of certain chemical factors influencing fungal growth in the apple. *Ann. Bot., Lond.*, **48**: 69–107.

———. 1944. Cultivation of mushrooms in Burma. *Indian Fmg.*, **5**: 520–22.

SHAFI, MD. 1932 *a*. Some diseases of the cotton plants of the Punjab. *Proc. 19th Indian Sci. Congr.* : 300.

———. 1932 *b*. Studies in physiology of *Fusarium* species from cotton. *Ibid.*, 300.

SHARMA, B. B. 1953 *a*. Latent infection in the fruits of *Aegle marmelos* Correa. *Proc. 40th Indian Sci. Congr.*, pt. III: 71.

———. 1953 *b*. The study of the life-history and the mode of infection of *Ustilago paradoxa* Syd. & Butl. on *Echinochloa frumentacea* (Roxb.) Link. *Ibid.*, pt. III: 71.

SHARMA, S. L. 1952. A new report of a rust [*Puccinia kuehnii* (Ureng.) Butler] on *Erianthus manja*. *Proc. 39th Indian Sci. Congr.*, pt. III: 308–09.

SHAW, F. J. F. 1911. The copper blight of tea. *Agric. J. India*, **6**: 78–79.

———. 1912. The morphology and parasitism of *Rhizoctonia*. *Mem. Dep. Agric. India, Bot.*, **4**: 115–53.

———. 1913 *a*. Anthracnose of sisal hemp. *Agric. J. India*, **8**: 65–68.

———. 1913 *b*. A sclerotial disease of rice. *Mem. Dep. Agric. India, Bot.*, **6**: 11–23.

———. 1921. Studies in diseases of the jute plant (1) *Diplodia corchori* Syd. *Ibid.*, **11**: 37–58.

———. 1923. Some factors in the incidence of plant diseases. *Proc. 10th Indian Sci. Congr.*: 192.

———. 1924. Studies in diseases of the jute plant (2) *Macrophoma corchori* Sac. *Mem. Dep. Agric. India, Bot.*, **13**: 193–99.

———. 1936. The inheritance of morphological characters and of wilt resistance in rehar (*Cajanus indicus* Spreng.). *Proc. Indian Acad. Sci.*, **3 B**: 491–92.

—— AND AJREKAR, S. L. 1915. The genus *Rhizoctonia* in India. *Mem. Dep. Agric. India, Bot.*, **7**: 177–94.

—— AND SUNDARARAMAN, S. 1914 *a*. The bud-rot of coconut palms in Malabar. *Agric. J. India*, **9**: 111–17.

—— AND ——. 1914 *b*. The bud-rot of coconut palms in Malabar. *Ann. mycol., Berl.*, **12**: 251–62.

SHEIKH, A. H. 1932 *a*. Study of the gram blight caused by *Ascochyta pisi*. *Proc. 19th Indian Sci. Congr.*, 300.

SHEIK, A. H. 1932 *b*. Study of *Cladosporium herbarum* on *Pisum sativum*. *Proc. 19th Indian Science Congr.*, 300.

SHIVAPURI, T. N. 1943. Relative study of the effect of different temperatures of uredospores of wheat, jowar and bajra rusts. *Proc. 30th Indian Sci. Congr.*, pt. III: 104.

SINGH, B. AND GUPTA, V. C. 1951 *a*. Diseases of spinach. *Curr. Sci.*, **20**: 104–05.

—— AND ——. 1951 *b*. An anthracnose disease of spinach. *Ibid.*, **20**: 239–40.

SINGH, B. N. AND CHAKRAVARTI, S. C. 1935. *Peucedanum graveolens*—A new host of powdery mildews. *Ibid.*, **4**: 238.

—— AND JAKHANWAL, G. P. 1937. The prevention of rots in tomatoes with special reference to the mould's attack. *Proc. nat. Acad. Sci. India*, **7**: 39–44.

SINGH, D. 1936. A disease of the pomegranate trees in Lahore caused by *Phoma* sp. *Proc. 23rd Indian Sci. Congr.* : 289.

SINGH, G. 1932 *a*. Fungus flora of Lahore soils. *Proc. 19th Indian Sci. Congr.* : 297.

———. 1932 *b*. A study of the cellulose decomposing power of soil fungi. *Ibid.*: 297.

SINGH, J. 1928. A study of Fusaria common to cotton plants and cotton soils in the Central Provinces. *Mem. Dep. Agric. India, Bot.*, **14**: 189–98.

———. 1933 *a*. Some diseases of the pomegranates. *Proc. 20th Indian Sci. Congr.* : 304.

———. 1933 *b*. Effect of X-rays on fungi. *Ibid.*: 305.

———. 1934 *a*. Leaf-spot disease of rice. *Proc. 21st Indian Sci. Congr.* : 297.

———. 1934 *b*. Stem-rot of rice caused by *Sclerotium oryzæ*. *Ibid.*: 297.

———. 1944. Effect of mercury on micro-organisms. *Curr. Sci.*, **13**: 236.

—— AND CHAND, H. 1937. Fungus flora of the Lahore soils. II. *Proc. 24th Indian Sci. Congr.* : 261.

SINGH, K. B. 1946. *Pythium* collar rot of field pea at Kanpur, U.P. *Curr. Sci.*, **15**: 195.

SINGH, R. S., MEHTA, P. R. AND SINGH, B. 1951. Red spot disease of leaves of jowar (*Andropogon sorghum* Brost.). *Indian Phytopath.*, **4**: 45–57.

SINGH, U. B. 1930. Studies in the genus *Cercospora*. (1) Morbid anatomy, (2) Changes undergone by four different species of *Cercospora* when grown in four different culture media. *Proc. 17th Indian Sci. Congr.* : 285.

———. 1931. Studies in the genus *Cercospora*. *J. Indian bot. Soc.*, **10**: 73–91.

———. 1933. Physiology of *Cercospora dolichii* E. and E. *Indian J. agric. Sci.*, **3**: 496–529.

———. 1934. Studies on *Cercospora indica* n. sp. parasitic on *Cajanus indicus* Spreng. *Ibid.*, **4**: 343–60.

———. 1941 *a*. Sooty-blotch and fly-speck of apple fruit in Kumaon. *Ibid.*, **11**: 597–602.

———. 1941 *b*. The soft-rot of apple fruit in Kumaon. *Ibid.*, **11**: 902–05.

———. 1942. Stem-brown disease of apple in Kumaon. *Ibid.*, **12**: 368–80.

———. 1943 *a*. The pink disease of apple in Kumaon. *Ibid.*, **13**: 528–30.

SINGH, U. B. 1943 *b*. Some diseases of fruits and fruit trees in Kumaon. I. *Misc. Bull. imp. Coun. agric. Res. India*, **51**: 5 and 11.

———. 1943 *c*. Control of fruit diseases in Kumaon. *Indian Frng.*, **4**: 411–12.

———. 1944. Leaf-spot disease of apple in Kumaon. *Ibid.*, **5**: 565–67.

———. 1948. Phytopathological examination of seeds by Ulster method. *Curr. Sci.*, **17**: 266.

SINGH, T. C. N. 1929. On the occurrence of *Entyloma* on *Selaginella*. *Proc. 16th Indian Sci. Congr.* : 238.

SINHA, S. 1939 *a*. On the characters of *Choanephora cucurbitarum* (B. and Rav.) Thaxter causing a wet rot of chillies. *Proc. 26th Indian Sci. Congr.*, Pt. III: 115.

———. 1939 *b*. A wet rot of leaves of *Colocasia antiquorum* due to secondary infection by *Blackslea trispora* and *Choanephora cucurbitarum* (B. & Rav.) Thaxt. *Ibid.*, Pt. III: 116.

———. 1940 *a*. On the characters of *Choanephora cucurbitarum* Thaxter on chillies (*Capsicum* spp.). *Proc. Indian Acad. Sci.*, **11 B**: 162–66.

———. 1940 *b*. A wet rot of leaves of *Colocasia antiquorum* due to secondary infection by *Choanephora cucurbitarum* Thaxter and *Choanephora trispora* Thaxter (= *Blakeslea trispora* Thaxter). *Ibid.*, **11 B**: 167–76.

———. 1943 *a*. Studies in the decay of fruits in storage. I. Investigation into the casual organisms and source of infection with a short note on the morphology of the fungi isolated. *Proc. 30th Indian Sci. Congr.*, pt. III: 46.

———. 1943 *b*. Studies in the decay of fruits in storage. II. On the pathogenicity of certain fungi attacking mango fruits. *Ibid.*, pt. III: 46.

———. 1946. On decay of certain fruits in storage. *Proc. Indian Acad. Sci.*, **24 B**: 198–205.

———. 1948. On the pathogenicity of certain fungi attacking mango fruits in storage. *J. Indian bot. Soc.*, **27**: 105–10.

———. 1950. Investigation of certain chemical factors affecting the growth of fungi in mangoes. *Ibid.*, **29**: 197–209.

SMALL, W. 1928. On *Rhizoctonia bataticola* (Taub.) Butler as a cause of root disease in the tropics. *Trans. Brit. mycol. Soc.*, **13**: 40–68.

SMITH, A. L. 1926. Cryptotheciaceæ. A family of primitive lichens. *Ibid.*, **11**: 189–96.

———. 1931. Lichens from Northern India. *Ibid.*, **16**: 128–32.

SOUMINI, C. K. 1949. Investigations on cereal rusts. III. *Puccinia purpurea* Cke. *Indian Phytopath.*, **2**: 35–38.

SREENIVASAYA, M. 1930 *a*. Contributions to the study of spike-disease of sandal. *J. Indian Inst. Sci.*, **13**: 113.

———. 1930 *b*. Occurrence of mannitol in spike-disease of sandal. *Nature, Lond.*, **126**: 438.

———. 1930 *c*. Masking of spike-disease symptom in *Santalum album*. *Ibid.*, **126**: 957.

———. 1934. Insect transmission of spike-disease. *Ibid.*, **133**: 382.

—— AND NAIDU, G. G. 1928. Contributions to the study of spike-disease of sandal. V. Transmission of spike by budding. *J. Indian Inst. Sci.*, **11**: 244–47.

SREENIVASAYA, M. AND RANGASWAMI, S. 1931. Contributions to the study of spike-disease of sandal (*Santalum album*). Part XII—Ecology of Sandal. *J. Indian Inst. Sci.*, **14**: 59–65.

—— AND ——. 1934. Field studies in the spike-disease of sandal. *Proc. Indian Acad. Sci.*, **1 B**: 143–54.

—— AND SASTRI, B. N. 1928. Contributions to the study of spike-disease of sandal. I. Diastatic acitivity of the leaves. *J. Indian Inst. Sci.*, **11**: 23–39.

—— AND ——. 1929. Contributions to the study of spike-disease of sandal. VIII. Chemical composition of tissue fluids from the leaf. *Ibid.*, **12**: 239–44.

SRINATH, K. V. 1946 *a*. The cytology of the yeast. *Curr. Sci.*, **15**: 25.

————. 1946 *b*. The chromosomes of *Saccharomyces cerevisiæ*. *Ibid.*, **15**: 50.

SRINIVASAN, K. S. 1939. On an ascomycetous fungus attacking *Riccia himalayensis* St. *Trans. Brit. mycol. Soc.*, **23**: 55–62.

SRINIVASAN, K. V. 1951. A hyperparasite on two species of *Kordyana* Rac. *Curr. Sci.*, **20**: 276.

SRIVASTAVA, H. C. AND MEHTA, P. R. 1951. A new species of *Cercospora* on *Grewia asiatica* Linn. *Indian Phytopath.*, **4**: 67–70.

SRIVASTAVA, J. P. 1951. Effect of various nitrogenous compounds on the growth of *Alternaria tenuis* Auct. sensu Wiltshire. *J. Indian bot. Soc.*, **30**: 108–12.

STEVENS, F. L. 1928. *Meliola* spp. from India and one from Malaya. *Mem. Dep. Agric. India, Bot.*, **15**: 107–11.

SUBBA RAO, N. S. 1954. Fluorescence phenomenon in fusariose wilt of cotton. *J. Indian bot. Soc.*, **33**: 443–45.

SUBRAMANIAM, L. S. 1919. A *Pythium* disease of ginger, tobacco and papaya. *Mem. Dep. Agric. India, Bot.*, **10**: 181–94.

————. 1928. Root-rot of wheat caused by *Pythium graminicolum*. *Proc. 15th Indian Sci. Congr.* : 232.

—— AND CHONA, S. L. 1938. Note on *Cephalosporium sacchari* Butl. (Causal organism of sugarcane wilt). *Indian J. agric. Sci.*, **8**: 189–90.

SUBRAMANIAM, M. K. 1945. Induction of polyploidy in *Saccharomyces cerevisiæ*. *Curr. Sci.*, **14**: 234.

————. 1951 *a*. Chromosomes in yeasts. *Nature, Lond.*, **168**: 427–28.

————. 1951 *b*. Nature and nurture in yeasts. *Proc. Indian Acad. Sci.*, **34 B**: 220–24.

————. 1953. Abnormal mitoses in tetraploid yeasts. *Ibid.*, **37 B**: 27–32.

—— AND RANGANATHAN, B. 1945 *a*. Mitosis during budding in *Saccharomyces cerevisiæ*. *Curr. Sci.*, **14**: 78.

—— AND ——. 1945 *b*. The chromosome number of *Saccharomyces cerevisiæ*. *Ibid.*, **14**: 131.

—— AND ——. 1947. Induction of mutations in yeasts by low temperatures. *Sci. and Cult.*, **13**: 102–05.

—— AND SREEPATHI RAO, S. K. 1952. Studies on the mutagenic action of chemical and physical agencies on yeasts. IV. The effect of camphor on fermenting yeast cultures. *Proc. Indian Acad. Sci.*, **35 B**: 1-27.

SUBRAMANIAN, C. V. 1946 *a*. Some factors affecting the growth and survival of *Fusarium vasinfectum* Atk., the cotton wilt pathogen in the soil, with special reference to microbiological antagonism. *J. Indian bot. Soc.*, **25**: 89–101.

SUBRAMANIAN, C. V. 1946 *b*. The saprophytic activity of *Fusarium vasinfectum*, the cotton wilt pathogen in the soil. I. Colonisation of cotton roots buried in the soil (*M. O. P. Iyengar Commem. Vol.*). *J. Indian bot. Soc.*, 209–13.

———. 1950. Soil conditions and wilt diseases in plants with special reference to *Fusarium vasinfectum* on cotton. *Proc. Indian Acad. Sci.*, **31 B**: 67–102.

———. 1951 *a*. Fusaria isolated from South Indian soils. *Nature, Lond.*, **168**: 561.

———. 1951 *b*. "Is there a 'wild type' in the genus *Fusarium*?" *Proc. nat. Inst. Sci. India*, **17 B**: 403–11.

———. 1952 *a*. Studies on South Indian Fusaria. II. Fusaria isolated from black cotton soils. *Ibid.*, **18**: 557–84.

———. 1952 *b*. Fungi isolated and recorded from Indian soils. *J. Madras Univ.*, **22 B**: 206–22.

———. 1952 *c*. Fungi Imperfecti from Madras—I. *Proc. Indian Acad. Sci.*, **36 B**: 43–53.

———. 1952 *d*. Fungi Imperfecti from Madras—II. *Ibid.*, **36 B**: 160–68.

———. 1952 *e*. Fungi Imperfecti from Madras—III. *Beltraniella* gen. nov. *Ibid.*, **36 B**: 223–28.

———. 1952 *f*. Studies on South Indian Fusaria. I. *Fusarium vasinfectum* Atk., with a note on its varieties and forms. *Proc. nat. Inst. Sci. India*, **18 B**: 273–85.

—— AND RAMAKRISHNAN, K. 1953. On the nature of the spore-appendage in *Neottiospora* Desm. *Proc. Indian Acad. Sci.*, **37 B**: 228–31.

SUBRAMANYAM, K. AND SREENIVASAYA, M. 1941. Proteoclastases in healthy and spiked leaves of *Santalum album*. *Proc. 28th Indian Sci. Congr.*, Pt. III: 264.

SUBRAMANYAN, V. 1928. Studies on spore formation by yeasts. *Proc. 15th Indian Sci. Congr.* : 226.

———. 1929. Studies on the physiology of yeasts. *Proc. 16th Indian Sci. Congr.*: 243.

SUD, S. R. AND LAL, K. 1929. Some further observations and experiments on the rust on *Launœa aspleniifolia* D.C. *Ibid.*, 233.

SULOCHANA, C. B. (MISS). 1952 *a*. Soil conditions and root diseases. III. With special reference to colonisation and survival of soil fusaria in soils treated with micro-elements. *Proc. Indian Acad. Sci.*, **35 B**: 209–13.

———. 1952 *b*. Soil conditions and root diseases. IV. The effect of micro-elements on the occurrence of bacteria, actinomycetes and fungi in soils. *Ibid.*, **36 B**: 19–33.

———. 1952 *c*. Soil conditions and root diseases. VI. Germination of conidia of *Fusarium vasinfectum* in micro-element amended soils. *Ibid.*, **36 B**: 229–33.

———. 1952 *d*. Soil conditions and root diseases. VII. Response of cotton plants to micro-element amendments and its relation to disese development. *Ibid.*, **36 B**: 234–42.

SUNANDA KAMATH, H. (MISS). 1947. The life-history of *Puccinia ruelliæ* (B. & Br.) on *Ruellia prostrata* Poir. *Ibid.*, **26 B**: 1–6.

SUNDARARAMAN, S. 1920. A new ginger disease in Godavari District. *Mem. Dep. Agric. India, Bot.*, **11**: 209–17.

———. 1921. *Ustilago crameri* Koern. on *Setaria italica* Beauv. *Bull. agric. Res. Inst. Pusa*, **97**. (Rev. in *J. Indian bot. Soc.*, **2**: 154.)

SUNDARARAMAN, S. 1922. *Helminthosporium* disease of rice. *Bull. agric., Res. Inst. Pusa,* **128**: 7.

———. *1924. Bud-rot of coconuts caused by Phytophthora palmivora. Agric. J. India,* **19**: *84–85.*

—— AND RAMAKRISHNAN, T. S. *1924.* The 'Mahali' disease of coconuts in Malabar. *Mem. Dep. Agric. India, Bot.,* **13**: 87–97.

—— AND ——. *1928 a.* Foot-rot and wilt of Antirrhinums. *Ibid., Bot.,* **16**: 83–100.

—— AND ——. 1928 *b.* A leaf-spot disease of safflower (*Carthamus tinctorius*) by *Cercospora carthami* nov. sp. *Agric. J. India,* **23**: 383–89.

—— AND THOMAS, K. M. 1927. The 'blast' disease of rice and its control. *Proc. 14th Indian Sci. Congr.*: 211–12.

SYDOW, H. AND MCRAE, W. 1930. Hyphomycetes Indiæ orientalis. *Ann. Cryptog., exot.,* **2**: 267–71.

SYDOW, H. P. AND BUTLER, E. J. 1906. Fungi Indiæ orientalis. Part I. *Ann. mycol., Berl.,* **4**: 424–45.

—— AND ——. 1907. Fungi Indiæ orientalis. Part II. *Ibid.,* **5**: 485–515.

—— AND ——. 1911. Fungi Indiæ orientalis. Part III. *Ibid.,* **9**: 372–421.

—— AND ——. 1912. Fungi Indiæ orientalis. Part IV. *Ibid.,* **10**: 243–80.

—— AND ——. 1916. Fungi Indiæ orientalis. Part V. *Ibid.,* **14**: 177–220.

TANDON, M. P. 1950. Sulphur requirements of *Pestalotia malorum* and *Pestalotia psidii. Proc. Indian Acad. Sci.,* **32 B**: 7–11.

TANDON, R. N. 1946. Preliminary observations on a new disease of wheat at Allahabad. *Proc. nat. Acad. Sci. India,* **16**: 1–5.

——, DAS, P. AND SRIVASTAVA, J. P. 1953. Black point disease of wheat. *Proc. 40th Indian Sci. Congr.,* Pt. III: 77.

—— AND MITRA, S. N. 1953. Storage rot of *Colocasia antiquorum* caused by *Fusarium cæruleum* (Lib.) Sacc. *Ibid.,* Pt. III: 77.

—— AND TANDON, M. P. 1948. Some pathological studies of *Pestalotia* sp. isolated from rotten hill apples. *Proc. nat. Acad. Sci. India,* **18**: 17–32.

—— AND ——. 1953. Effect of sulpha drugs on the growth of *Pestalotia* spp. *Proc. 40th Indian Sci. Congr.,* pt. III: 76.

TAYLOR, T. 1847. New lichens principally from the herbarium of Sir J. D. Hooker. *Hook. Icon. Plant,* **6**: 148–97.

THADANI, K. I. 1936. Some notes of the incidence of disease and resistance to pathological and other adverse conditions in crops of Sind. *Proc. Indian Acad. Sci.,* **3 B**: 470–80.

THAKUR, A. K. 1926. Ammonification by soil-fungi. *Proc. 13th Indian Sci, Congr.* : 32.

—— AND NORRIS, R. V. 1927. The production of ammonia by soil fungi. *Proc. 14th Indian Sci. Congr.* : 34.

—— AND ——. 1928. A biochemical study of some soil fungi with special reference to ammonia production. *J. Indian Inst. Sci.,* **114**: 141–60.

THEISSEN, F. 1912. The fungi of India. Pt. I. *J. Bombay nat. Hist. Soc.,* **21**: 1273–1303.

———. 1913. The fungi of India. Pt. II. *Ibid.,* **22**: 144–59.

THETSU, U. AND SETH, L. N. 1940. Cultivation of the straw mushroom. *Indian Fmg.*, **1**, 332–33.

THIND, K. S. 1941 *a*. Mildews of the Central Punjab. *Proc. 28th Indian Sci. Congr.*, Pt. III: 158.

———. 1941 *b*. Study of some rusts of the Punjab. *Ibid.*, pt. III: 158.

———. 1941 *c*. *Cercospora* of Lahore. *Ibid.*, pt. III: 158.

———. 1942 *a*. *Puccinia phyllocladiæ* Cooke., a new record for India. *J. Indian bot. Soc.*, **21**: 195–96.

———. 1942 *b*. The genus *Peronospora* in the Punjab. *Ibid.*, **21**: 197–215.

—— AND KEITT, G. W. 1949. Studies on variability of *Sclerotinia fruticola* (Wint.) Rehm. *Phytopathology*, **39**: 621–36.

THIRUMALACHAR, M. J. 1938. On the morphology, cytology and parasitism of *Uromyces hobsoni* Vize (*U. cunninghamianus*). A preliminary note. *J. Indian bot. Soc.*, **17**: 295–99.

———. 1939. Rust on *Jasminum grandiflorum*. *Phytopathology*, **29**: 783–92.

———. 1940. A method for germinating and staining teleutospores. *J. Indian bot. Soc.*, **19**: 71–75.

———. 1941 *a*. *Tuberculina* on *Uromyces hobsoni* Vize. *Ibid.*, **20**: 107–10.

———. 1941 *b*. *Hapalophragmium ponderosum* Syd. on *Acacia leucophalæa* Willd. *Ibid.*, **20**: 293–98.

———. 1941 *c*. A new species of *Puccinia* on *Ocimum adscendeus*. *Proc. Indian Acad. Sci.*, **14 B**: 466–71.

———. 1941 *d*. A preliminary note on a *Melampsora* parasitic on *Lobelia trigona* Roxb. *Curr. Sci.*, **10**: 366.

———. 1942 *a*. Morphological and cytological study of the rust on *Hedyotis stylosa* [*Chrysocelis ascotela* (Syd.) Comb. nov.]. *J. Indian bot. Soc.*, **21**: 173–77.

———. 1942 *b*. Two new species of *Didymopsora* from India. *Proc. Indian Acad. Sci.*, **16 B**: 165–74.

———. 1942 *c*. *Phragmotelium mysorensis*, a new rust on Indian raspberry. *Ibid.*, **15 B**: 186–93.

———. 1942 *d*. *Tuberculina*. *Curr. Sci.*, **11**: 23.

———. 1942 *e*. Smut diseases of wheat. *Ibid.*, **11**: 78.

———. 1942 *f*. A new species of *Puccinia* on *Chomelia asiatica* O. Kze. *Ibid.*, **11**: 197.

———. 1942 *g*. *Puccinia droogenesis* Butler on *Berberis asiatica* D.C. *Ibid.*, **11**: 282–83.

———. 1942 *h*. *Olpidium uredinis* parasitic within the urediospores of *Hemileia canthii* Berk. and Broome. *Ibid.*, **11**: 363.

———. 1943 *a*. *Masseella narasimhanii*, a new species of rust on *Fluggea leucopyros* Willd. *Proc. Indian Acad. Sci.*, **18 B**: 36–40.

———. 1943 *b*. A new rust disease of cardamoms. *Curr. Sci.*, **12**: 231–32.

———. 1943 *c*. Ergot on sugarcane in Mysore. *Ibid.*, **12**: 330–31.

———. 1944 *a*. Ergot on *Cynodon dactylon* Pers. *Ibid.*, **13**: 288.

THIRUMALACHAR, M. J. 1944 *b*. Some new or noteworthy fungi. *Proc. 31st Indian Sci. Congr.*, pt. III: 78–79.

———. 1944 *c*. *Mundkurella*, a new genus of smut. *Ibid.*, pt. III: 79–80.

———. 1944 *d*. A new genus of smuts. *Mycologia*, **36**: 591–97.

———. 1945 *a*. Ergot and sphacelial stages on some wild grasses in Mysore. *Curr. Sci.*, **14**: 22.

———. 1945 *b*. An ascomycetous parasite of *Cephaleuros*. *Proc. Indian Acad. Sci.*, **22 B**: 374–77.

———. 1945 *c*. Some noteworthy rusts. I. *Mycologia*, **37**: 295–310.

———. 1945 *d*. Development of spore forms and the nuclear cycle in the autœcious opsis rust, *Cystopsora oleæ*. *Bot. Gaz.*, **107**: 74–86.

———. 1946 *a*. An undescribed species of *Elsinœ* from Mysore. *Mycologia*, **38**: 220–25.

———. 1946 *b*. *Kernia*, a new genus of the Uredinales. *Ibid.*, **38**: 679–86.

———. 1946 *c*. Some fungicolous fungi. *Proc. 33rd Indian Sci. Congr.*, pt. III: 113.

———. 1946 *d*. A cytological study of *Uromyces alœs*. *Bot. Gaz.*, **108**: 245–53.

———. 1947 *a*. Some noteworthy rusts. II. *Mycologia*, **39**: 231–48.

———. 1947 *b*. Brief notes on the genera *Stereostratum* Magr. and *Anthomycetella* Syd. *Ibid.*, **39**: 334–40.

———. 1947 *c*. Species of the genera *Doassansia*, *Doassansiopsis* and *Burrillia* in India. *Ibid.*, **39**: 602–11.

———. 1948 *a*. Some new *Sphaceloma* diseases of economic plants in Mysore. *Trans. Brit. mycol. Soc.*, **31**: 1–6.

———. 1948 *b*. Some fungal diseases of bryophytes in Mysore. *Ibid.*, **31**: 7–12.

———. 1949 *a*. A chytridiaceous parasite on *Limnanthemum indicum*. *Indian Phytopath.*, **2**: 128–31.

———. 1949 *b*. Angular leaf spot of Kudzu in Mysore. *Curr. Sci.*, **18**: 16.

———. 1949 *c*. Telia of the leaf rust on teak. *Ibid.*, **18**: 175–77.

———. 1950 *a*. Notes on Indian Ustilagineæ. I. *Lloydia*, **13**: 165–72.

———. 1950 *b*. Notes on Indian Ustilagineæ. II. *Ibid.*, **13**: 173–76.

———. 1950 *c*. Some noteworthy rusts. III. *Mycologia*, **42**: 224–32.

———. 1951. Ozonium wilt disease of potato. *Curr. Sci.*, **20**: 244–45.

———. 1952. Studies on the charcoal rot disease of potatoes in Bihar. *Proc. 39th Indian Sci. Congr.*, pt. III: 37.

———. 1953. *Cercospora* leaf-spot and stem canker disease of potatoes. *Amer. Potato J.*, **30**: 94–97.

—— AND CHUPP, C. 1948. Notes on some Cercosporæ of India. *Mycologia*. **40**: 352–62.

—— AND CUMMINS, G. B. 1948. Status of the rust genera *Allopuccinia*, *Leucotelium*, *Edythea* and *Ypsilospora*. *Ibid.*, **40**: 417–22.

THIRUMALACHAR, M. J. AND CUMMINS, G. B. 1949. The taxonomic significance of sporogenous basal cells in the Uredinales. *Mycologia*, **41**: 523–26.

—— AND DICKSON, J. G. 1947 *a*. Chlamydospore germination and artificial culture of *Ustilago striæformis* from timothy and bluegrass. *Phytopathology*, **37**: 730–34.

—— AND ——. 1947 *b*. A *Physoderma* disease of quack grass. *Ibid.*, **37**: 885–88.

—— AND ——. 1949. The cytology and life-cycle of a cypericolous *Entyloma* sp. *Amer. J. Bot.*, **36**: 404.

—— AND KERN, D. 1949. Notes on some species of *Phakopsora* and *Angiospora*. *Mycologia*, **41**: 283–90.

—— AND MUNDKUR, B. B. 1947. Morphology and the mode of transmission of the ragi smut. *Phytopathology*, **37**: 481–86.

—— AND ——. 1949 *a*. Genera of rusts. I. *Indian Phytopath.*, **2**: 65–101.

—— AND ——. 1949 *b*. Genera of rusts. II. *Ibid.*, **2**: 194–244.

—— AND ——. 1950 *a*. Genera of rusts. III. *Ibid.*, **3**: 4–42.

—— AND ——. 1950 *b*. Genera of rusts. Appendix. *Ibid.*, **3**: 203–04.

—— AND NARASIMHAN, M. J. 1949 *a*. Downy mildew on *Eleusine coracana* and *Iseilema laxum*. *Ibid.*, **2**: 46–51.

—— AND ——. 1949 *b*. Preliminary note on heteroecism of *Puccinia versicolor*. *Curr., Sci.*, **18**: 252.

—— AND RAMAMURTHI, C. S. 1952. Dry-rot of tubers and sprout injury in potato incited by *Aspergillus* sp. *Proc. 39th Indian Sci. Congr.*, pt. III: 38.

——, SUBBA RAO, D. V. AND RAVINDRA NATH, V. 1950. Telia of the rust on cultivated figs. *Curr. Sci.*, **19**: 27.

—— AND WHITEHEAD, M. D. 1951. An undescribed species of *Physoderma* on *Aeschynomene indica*. *Mycologia*, **43**: 430–36.

——, —— AND BOYLE, J. S. 1950. Gametogenesis and oospore formation in *Cystopus* (*Albugo*) *evolvuli*. *Bot. Gaz.*, **110**: 487–91.

THIVY, F. 1947. The systematics and bionomics of the mushrooms of Madras. I. Edible species. *Proc. 34th Indian Sci. Congr.*, pt. III: 151.

THOMAS, K. M. 1927. Some observations on varietal resistance to 'Rust' of coffee. *Proc. 14th Indian Sci. Congr.* : 212.

—— AND KRISHNASWAMI, C. S. 1939. Little leaf—a transmissible disease of brinjal. *Proc. Indian Acad. Sci.*, **10 B**: 201–12.

—— AND RAMAKRISHNAN, T. S. 1948. Studies in the genus *Phytophthora*—II. *Ibid.*, **27 B**: 55–73.

——, ——, SOUMINI, C. K. AND BALAKRISHNAN, M. S. 1947. Studies in the genus *Phytophthora*. I. Oospore formation and taxonomy of *Phytophthora palmivora* Butler. *Ibid.*, **26 B**: 147–63.

——, —— AND SRINIVASAN, K. V. 1945 *a*. The natural occurrence of ergot in South India. *Ibid.*, **21 B**: 93–100.

——, —— AND ——. 1945 *b*. The natural occurrence of ergot in South India. II. *Ibid.*, **22 B**: 191–92.

TROUP, R. S. 1912. *Peridermium cedri* as a destructive fungus. *Indian For.*, **38**: 222–23.

TROUP, R. S. 1914. *Peridermium cedri* as a destructive fungus. *Indian For.*, **40**: 469–72.

TUNSTALL, A. C. 1934. A new species of *Glomerella* on *Camellia theæ*. *Trans. Brit. mycol. Soc.*, **19**: 331–36.

UPPAL, B. N. 1926. Relation of oxygen to spore germination in some species of the Peronosporales. *Phytopathology*, **16**: 285–92.

———. 1928. The mosaic disease of chillies in Bombay Presidency. *Int. Bull. Pl. Prot.*, **3**: 99.

———. 1930. Summary of work done under the Plant Pathologist, Bombay Presidency, Poona, for the year 1929-30. *Annul Rep. Dep. Agric., Bombay* (1929–30), 233–36.

———. 1934 *a*. Summary of work done under the Plant Pathologist, Bombay Presidency, Poona, for the year 1933–34. Appendix X to *Ibid.* (1933–34), 174–81.

———. 1934 *b*. The absorption and elution of cucumber mosaic virus. *Indian J. agric. Sci.*, **4**: 656–62.

———. 1934 *c*. The movement of tobacco mosaic in the leaves of *Nicotiana sylvestris*. *Ibid.*, **4**: 865–73.

———. 1948. Diseases of cotton in India. *Abstr. Indian Cott. Comm.*, pp. 32.

—— AND CAPOOR, S. P. 1940. The movement of virus within the host. *Proc. Crops Soils Bd. Agric. India*, 164–70.

——,—— AND RAYCHUDHURI, S. P. 1944. Small leaf of cotton. *Curr. Sci.*, **13**: 284–85.

—— AND DESAI, M. K. 1931. Effectiveness of dust fungicides in controlling grain smut of jowar. *Agric. Live-stk. India*, **1**: 396–413.

—— AND ——. 1932 *a*. Physiologic specialisation in *Sclerospora graminicola* (Sacc.) Schroet. *Indian J. agric. Sci.*, **2**: 667–78.

—— AND ——. 1932 *b*. Two new hosts of the downy mildew of sorghum in Bombay. *Phytopathology*, **22**: 587–94.

—— AND ——. 1939. Koleroga disease of arecanut. *Curr. Sci.*, **8**: 122–24.

—— AND GOKHALE, V. P. 1947. A new race of *Puccinia graminis tritici* and two biotypes of Race 42. *Ibid.*, **16**: 61.

—— AND KAMAT, M. N. 1928. Artificial infection of *Pennisetum typhoideum* by *Sclerospora graminicola*. *Agric. J. India*, **23**: 309–10.

—— AND ——. 1936. Gummosis of citrus in Bombay. *Indian J. Agric. Sci.*, **6**: 803–21.

—— AND ——. 1937. Powdery mildew of betel vine. *Curr. Sci.*, **6**: 611.

UPPAL, B. N., KAMAT, M. N. AND PATEL, M. K. 1936. A new variety of *Oidiopsis taurica*. *Indian J. agric. Sci.*, **6**: 110–15.

——, —— AND ——. 1937. The systematic position of *Oidiopsis taurica* (Lev.) Salmon. *Curr. Sci.*, **6**: 103.

——, —— AND ——. 1946. Powdery mildew of betel vines. *Proc. Indian Acad. Sci.*, **24 B**: 255–59.

—— AND KULKARNI, N. T. 1935. *Fusarium* wilt in sannhemp. *Curr. Sci.*, **4**: 314–15.

—— AND ——. 1937. Studies in *Fusarium* wilt of sann-hemp. I. The Physiology and biology of *Fusarium vasinfectum* Atk. *Indian J. agric. Sci.*, **7**: 413–42.

UPPAL, B. AND MALELU, J. S. 1928. A preliminary report on experiments in the control of grain smut of jowar (*Andropogon sorghum*). *Agric. J. India*, **23**: 471–72.

—— AND PATEL, M. K. 1943. Long smut of *Sorghum purpureosericcum*. *Indian J. agric. Sci.*, **13**: 520–51.

—— AND BHIDE, V. P. 1949. Four new species of fungi from Bombay. *Indian Phytopath.*, **2**: 176–79.

—— AND —— AND KAMAT, M. N. 1935. *The Fungi of Bombay*, viii + 56 pp.

——, —— AND ——. 1938 *a*. *Alternaria* blight of Cumin. *Indian J. agric. Sci.*, **8**: 49–62.

——, —— AND ——. 1938 *b*. Bacterial leaf-spot of soyabean in Bombay. *J. Univ. Bombay*, **6 A**: 16–18.

——,—— AND NIKAM, B. G. 1946. Bacterial blight of *Phaseolus vulgaris* var. White kidney. *Proc. nat. Inst. Sci. India*, **12**: 351–59.

——, VARMA, P. M. AND CAPOOR, S. P. 1940. Yellow mosaic of bhendi. *Curr. Sci.*, **9**: 227–28.

——, —— AND ——. 1945. A mosaic disease of cardamom. *Ibid.*, **14**: 208–09.

—— AND WESTON, WM. H. (JR.). 1936. The basis for merging *Sclerospora indica* with *S. philippinensis*. *Indian J. agric. Sci.*, **6**: 715–19.

VAHEEDUDDIN, S. 1937. Intergeneric hybridization and evidence of heterosis in loose and head smuts of sorghum. *Proc. 24th Indian Sci. Congr.* : 260.

———. 1950. Two new physiologic races of *Sphacelotheca sorghi*. *Indian Phytopath.*, **3**: 162–64.

———. 1953 *a*. Seed dressing trials for controlling leaf blotch (*Helminthosporium*) of maize. *Proc. 40th Indian Sci. Congr.*, pt. III: 81.

———. 1953 *b*. Spraying and dusting trial to control blast (*Piricularia oryzæ*) of paddy. *Ibid.*, pt. III: 81.

VARADARAJAN, B. S. AND PATEL, J. S. 1943. Stem-rot disease of jute. *Indian J. agric. Sci.*, **13**: 148–56.

VARGHESE, M. K. 1945. Bunchy top disease of plantains. *Indian Fmg.*, **6**: 239–40.

VARMA, P. M. 1952. Studies on the relationship of bhendi yellow vein mosaic virus and its vector, the white-fly (*Bemisia tabaci*). *Indian J. agric. Sci.*, **22**: 75–91.

—— AND CAPOOR, S. P. 1953. 'Marble' disease of cardamom. *Indian Fmg.*, N.S., **3** (5): 22–23.

——,—— AND PATEL, M. K. 1950. Yellow vein mosaic of bhendi (*Hibiscus esculentus*). *Proc. 37th Indian Sci. Congr.*, pt. III.

VASUDEVA, R. S. 1930 *a*. Studies in the physiology of parasitism. XI. An analysis of the factors underlying specialization of parasitism with special reference to the fungi *Botrytis allii* Munn. and *Monilia fructigena* Pres. *Ann. Bot., Lond.*, **44**: 469–93.

———. 1930 *b*. Studies in the physiology of parasitism. XII. On the effect of one organism in reducing the parasitic activity of another. *Ibid.*, **44**: 557–64.

———. 1930 *c*. On the occurrence of "False Sectors" in cultures of *Fusarium fructigenum*. *Trans. Brit. mycol. Soc.*, **15**: 96–101.

———. 1933. Studies in the physiology of parasitism. Effect of one organism on the parasitic activity of another. *Proc. 20th Indian Sci. Congr.* : 321.

———. 1935 *a*. Effect of one organism on the parasitic activity of another. *J. Indian bot. Soc.*, **14**: 71–83.

VASUDEVA, R. S. 1935 *b*. Studies on the root-rot disease of cotton in the Punjab. I. Symptoms, incidence and cause of the disease. *Indian J. agric. Sci.*, **5**: 496–512.

———. 1936. Studies on the root-rot disease of cotton in the Punjab. II. Some studies in the physiology of the causal fungus. *Ibid.*, **6**: 904–16.

———. 1937 *a*. Studies on the root-rot disease of cotton in the Punjab. III. The effect of some physical and chemical factors on sclerotia formation. *Ibid.*, **7**: 259–70.

———. 1937 *b*. Studies on the root-rot disease of cotton in the Punjab. IV. The effect of certain factors influencing incidence of the disease. *Ibid.*, **7**: 575–87.

———. 1941. Studies on the root-rot disease of cotton in the Punjab. XI. Effect of mixed cropping on the incidence of the disease. *Ibid.*, **11**: 879–91.

———. 1942. A mosaic disease of cowpea. *Ibid.*, **12**: 281–83.

———. 1943. Studies on the root-rot disease of cotton in the Punjab. XII. Control by varying sowing date. *Ibid.*, **13**: 515–19.

———. 1945. Studies on the root-rot disease of cotton in the Punjab. *Ibid.*, **15**: 36–41.

———. 1946. A mosaic disease of potatoes in India. Masking of symptoms and yield in relation to mosaic. *Indian Fmg.*, **7**: 170–73.

———. 1947. Building up of disease-free stocks of seed potatoes. *Ibid.*, **8**: 282–84.

—— AND ASHRAF, M. 1939. Studies on the root-rot disease of cotton in the Punjab. VII. Further investigation of factors influencing the disease. *Indian J. agric. Sci.*, **9**: 595–608.

—— AND AZAD, R. N. 1948. Potato necrosis. *Curr. Sci.*, **17**: 216–17.

—— AHD ——. 1949 *a*. Late blight of potatoes in the plains. *Indian Fmg.*, **10**: 345.

—— AND ——. 1949 *b*. Seeds from partially disease-free potato crops. *Ibid.*, **10**: 433–35.

—— AND ——. 1952. Investigations on potato disease and production of disease-free seed potatoes in India. *Emp. J. expt. Agric.*, **20**: 293.

——, GARG, R. P. AND AZAD., R. N. 1949. Necrosis in tomato. *Curr. Sci.*, **18**: 411.

—— AND GATTANI, M. L. 1951. Assessment of losses caused by plant diseases. *Indian J. agric. Sci.*, **21**: 409–12.

—— AND GOVINDASWAMY, C. V. 1953. Studies on the effect of associated soil microflora on *Fusarium udum*—the fungus causing wilt of pigeon pea, with special reference to its pathogenicity. *Ann. appl. Biol.*, **40**: 573–83.

—— AND GUPTA, D. 1947. Foliar necrosis of potato variety Phulwa. *Indian J. agric. Sci.*, **16**: 469–70.

—— AND LAL, T. B. 1943. A mosaic disease of bottle-gourd. *Ibid.*, **13**: 182–91.

—— AND ——. 1944 *a*. Big bud disease of the tomato. *Ibid.*, **14**: 160–62.

—— AND ——. 1944 *b*. Studies on the virus diseases of potatoes in India. I. Occurrence of solanum virus 1. *Ibid.*, **14**: 288–95.

—— AND ——. 1945. Studies on the virus diseases of potatoes in India. II. Solanum virus 2. (Orton) India. *Ibid.*, **15**: 240–41.

—— AND ——. 1947. Some experiments on the control of tomato virus disease. *Indian Fmg.*, **8**: 183.

VASUDEVA, R. S. AND NARIANI, T. K. 1952. Host range of bottle-gourd mosaic virus and its inactivation by plant extracts. *Phytopathology*, **42**: 149–52.

—— AND PAVGI, M. S. 1945. Seed transmission of melon mosaic virus. *Curr. Sci.*, **14**: 271–72.

—— AND RAFIQUE, M. 1939. Studies on the root-rot disease of cotton in the Punjab. VI. Chemical composition of healthy and diseased cotton plants. *Indian J. agric. Sci.*, **9**: 331–42.

——— AND RAMAMOORTHI, C. S. 1946. Studies on the virus diseases of potatoes in India. III. Occurrence of solanum virus 3. Murphy and McKay. *Ibid.*, **16**: 206–08.

——, RAYCHAUDHURI, S. P. AND PATHANIAN, P. S. 1948. Yellow mosaic of lettuce. *Curr. Sci.*, **17**: 244–45.

——,—— AND SINGH, J. 1949. A new strain of cucumis virus 2 *c*. *Indian Phytopath.*, **2**: 180–85.

—— AND SAMRAJ, J. 1947. A latent virus in tomato. *Curr. Sci.*, **16**: 348–50.

—— AND ——. 1948. A leaf curl disease of tomato. *Phytopathology*, **38**: 364–69.

—— AND SESHADRI IYENGAR, M. R. 1950 *a*. Secondary infection in the bajra smut disease caused by *Tolyposporium penicillariæ* Bref. *Curr. Sci.*, **19**: 123.

——,——. 1950 *b*. Mode of transmission of the long smut of jowar. *Ibid.*, **19**: 123.

——,——. 1950 *c*. Control of loose smut of barley. *Ibid.*, **19**: 218.

—— AND SIKKA, M. R. 1941. Studies on the root-rot disease of cotton in the Punjab. X. Effect of certain fungi on the growth of root-rot fungi. *Indian J. agric. Sci.*, **11**: 422–31.

VENKATAKRISHNAIAH, N. S. 1951. The perithecial stage of *Erysiphe polygoni* Dc. on pea (*Pisum sativum* Linn.). *Curr. Sci.*, **20**: 137.

———. 1952. *Glomerella psidii* (Del.) Sheld. and *Pestalotia psidii* associated with a canker disease of guava. *Proc. Indian Acad. Sci.*, **36 B**: 129–34.

———. 1946 *a*. Preliminary note on the occurrence of a *Phytophthora* on French bean *Phaseolus vulgaris* Linn. *Proc. 33rd Indian Sci. Congr.*, pt. III: 176.

———. 1946 *b*. Perfect stage of *Sclerotium rolfsii* Sacc. causing pseudostem rot of plantain (*Musa sapientum*). *Curr. Sci.*, **15**: 259.

———. 1946. *Ephelis* on two new hosts. *Ibid.*, **15**: 260.

———. 1950. *Phytophthora parasitica* on French bean *Phaseolus vulgaris* Linn. *Indian J. agric. Sci.*, **20**: 391–94.

VENKATARAMAN, T. S. AND THOMAS, R. 1928. A leaf adaptation conducive to mosaic resistance in the sugarcane. *Agric. J. India*, **23**: 56–57.

VENKATARAMANI, K. S. 1952. A tea root disease new to South India. *Nature, Lond.*, **169**: 1099–1100.

VENKATA RAO, M. G. 1933. A preliminary note on the leaf-curl mosaic disease of sandal. *Mysore Sandal Invest. Bull.*, **3**: 5.

———. 1935. Role of undergrowth in the spread of spike disease. *Indian For.*, **61**: 169.

———. 1938. Influence of host plant on sandal and spike disease. *Ibid.*, **64**: 656.

—— AND IYNEGAR, K. G. 1934 *a*. Two types of spike diseases. *Ibid.*, **60**: 481.

VENKATA RAO, M. G. AND IYENGAR, K. G. 1934 *b*. Studies in the spike disease of sandal. *Indian For.*, **60**: 689.

VENKATA RAU, M. K. 1916. Some diseases on trees in Mysore caused by a species of *Phytophthora*. *J. Bombay nat. Hist. Soc.*, **24**: 651.

VENKATARAYAN, S. V. 1932. *Phytophthora arecæ* parasitic on *Areca* tops and a strain of *P. palmivora* Butl. (*P. faberi* Maubl.) on a new host, *Aleurites fordi*. *Phytopathology*, **22**: 217–27.

———. 1946*a*. Mosaic disease of ragi. *Curr. Sci.*, **15**: 258–59.

———. 1946 *b*. A natural fungus parasite of powdery midlew on *Cyamopsis psoralioides* Dc. *Ibid.*, **15**: 319.

———. 1947. Mosaic disease of *Malvastrum coramandelianum*. *Ibid.*, **16**: 347–48.

———. 1949 *a*. Smut on the mat sedge, *Cyperus pangorei*, Rottb. *Ibid.*, **18**: 13.

———. 1949 *b*. The validity of the name *Pellicularia koleroga* Cooke. *Indian Phytopath.*, **2**: 186–89.

———. 1950. Notes on some species of *Corticium* and *Pellicularia*. *Ibid.*, **3**: 81–86.

———. 1951. *Triphragmium ponderosum* (Syd. & Butl.) comb. nov. *Trans. Brit. mycol. Soc.*, **34**: 237–39.

—— AND DELVI, M. H. 1951 *a*. Black mould of onions in storage caused by *Aspergillus niger*. *Curr. Sci.*, **20**: 243–44.

—— AND ——. 1951 *b*. Smut on *Echinochloa colona* Link. *Ibid.*, **20**: 329–30.

VERMA, G. S. 1937. The occurrence of *Cystopus ipomæ-panduratæ* (Schw.) Swingle on *Ipomæa pestigridis* Linn. *Ibid.*, **6**: 99.

———. 1939. A new species of *Bombardia* occurring on dry twigs of *Thunbergia grandiflora* Roxb. *Proc. 26th Indian Sci. Congr.*, pt. III: 115–16.

———. 1940. A new species of *Bombardia* (*B. hyalina* sp. nov.) occurring on dry twigs of *Thunbergia grandiflora* Roxb. *Proc. Indian Acad. Sci.*, **11 B**: 45–49.

———. 1946. Soft rot of radish (*Raphanus sativa* Linn.). *Proc. 33rd Indian Sci. Congr.*, pt. III: 113.

———. 1951. Wilt disease of *Acacia melanoxylon* R. Br. *J. Indian bot. Soc.*, **30**: 14–27.

———. 1952. The formation of lesions by gases on mango fruits. *Ibid.*, **31**: 316–41.

VERMA, G. S. AND KAMAL, M. 1951. Fruit-rot of *Mangifera indica* Linn. caused by *Aspergillus*. *Curr. Sci.*, **20**: 68–69.

VISWA NATH, B. 1936. Disease resistance in plants in relation to nutrition balance. *Proc. Indian Acad. Sci.*, **3 B**: 459–69.

WHITEHOUSE, H. L. K. 1951. The significance of some sexual phenomenon in the fungi. *Indian Phytopath.*, **4**: 91–105.

WOODHOUSE, E. J. 1909. The mangoes of Bihar. *Quart. J. Dep. Agric. Beng.*, **2**: 283.

WESTON, W. H. AND UPPAL, B. N. 1932. The basis for *Sclerospora sorghi* as a species. *Phytopathology*, **22**: 573–86.

YOGESWARI, L. (MISS). 1948. Trace element nutrition of fungi. I. The effect of boron, zinc and manganese on *Fusarium* species. *Proc. Indian Acad. Sci.*, **28 B**: 177–201.

ZACHARIAH, A. T. (MISS). 1953. Soil conditions and root diseases. IX. Fungal ecology of cultivated fields—Techniques. *Proc. Indian Acad. Sci.*, **38 B**: 235–41.

ZAHLBRUCKNER, A. 1911. Flechten des Neuguinea-Archipels, der hawaiischen Inseln und der Insel Ceylon. *Denkschr. Akad. Wiss. Wien.*, **88**: 12–31.

———. 1932. Neue Flechten. XI. *Ann. mycol., Berl.*, **30**: 427–41.

VETERINARY AND MEDICAL MYCOLOGY

ACTON, H. W. 1918–19 *a*. The diagnosis of acute infections of the throat amongst troops of the Mesopotamian expeditionary force. *Indian J. med. Res.*, **6**: 152.

———. 1919–19 *b*. Mycotic affections of the throat due to *Endomyces tropicalis*. *Ibid.*, **6**: 591.

—— AND GHOSH, L. M. 1934. *Tinea imbricata* (Tokelau) in Bengal. *Indian Med. Gaz.*, **69**: 426–30.

—— AND MCGUIRE, C. 1927. *Tinea cruris*—its manifestation, diagnosis and treatment. *Ibid.*, **64**: 24.

—— AND ——. 1929. A purulent folliculitis due to *Trichophyton violaceum* var. *indicum*. *Ibid.*, **64**: 24.

—— AND ——. 1930. Keratolysis Plantare sulcatum, a lesion due to an actinomycotic fungus. *Ibid.*, **65**: 61–65.

—— AND ——. 1931. Actinomycotic lesions of the hands and feet due to *Actinomyces keratolytica*. *Ibid.*, **66**: 65.

—— AND PANJA, G. 1927. Seborrhic dermatitis or Pityriasis capitis. *Ibid.*, **62**: 603.

ANDLEIGH, H. S. 1951 *a*. Two rare cases of fungus infection of skin in Rajasthan: Actinomycosis and rhinosporidiosis. *Ibid.*, **86**: 100.

———. 1951 *b*. Blastomycosis in India. *Indian J. med. Sci.*, **5**: 59.

———. 1951 *c*. Mycotic infections. *Ibid.*, **5**: 168.

ASTHANA, R. P. 1944. Aspergillosis in fowls. *Proc. Indian Acad. Sci.*, **20 B**: 43–47.

AYYAR, V. K. 1925. Nasal granuloma in cattle. *Mem. Dep. Agric. India, Vet.*, **3**: 159.

———. 1927. Rhinosporidiosis in cattle. *Trans.* (7th Congr.) *Far.-East Ass. trop. Med.*, **3**: 658–64.

———. 1932. Rhinosporidiosis in equines. *Indian J. vet. Sci.*, **11**: 49–52.

BASU, C. C. 1953. Human actinomycosis. *Indian med. Gaz.*, **87**: 237–44.

BATT, J. V. AND SHETTY, MEENAKSHI, V. 1946. An instance of the occurrence of *Monilia albicans* (*Candida albicans*) in dentral caries. *Curr. Sci.*, **15**: 228.

BISWAL, G. 1947. Ringworm in calves. *Indian vet. J.*, **24**: 179–82.

BOCCARO, J. E. 1894. Clinical notes on mycetoma differentiating the pale from the black variety. *Indian med. Gaz.*, **29**: 451.

BRADFIELD, E. W. C. AND VASUDEVAN, A. 1927. Mycetoma. *Ibid.*, **62**: 633–34.

CASTELLANI, A. 1905. Observations on dhobie itch and other tropical trichophytic diseases. *Brit. med. J.*, **2**: 1277–79.

———. 1910. Observations on a new species of *Tinea Epidermophyton* found in *cruris*. *Brit. J. Derm.*, **22**: 147–50.

———. 1915. Tokelau (*Tinea imbricata*). *Trop. Dix. Bull.*, **6**: 135.

CASTELLANI, A. 1920 *a*. The etiology of thrush. *J. trop. Med.* (*Hyd.*), **23**: 17.

———. 1920 *b*. Milroy lectures on higher fungi in relation to human pathology. *Ibid.*, **23**: 101.

CHAUDHURY, H., SINGH, B. AND THIND, K. S. 1945. A note on the life-history and systematic position of *Rhinosporidium seeberi* (Wernicke). *J. Indian bot. Soc.*, **24**: 4–9.

DEMELLO, F. 1917–18. *Trichophyton viannæ* n. sp. The infecting agent in case of dermatomycosis. *Indian J. med. Res.* **5**: 222.

—— AND RODRIGUES, A. 1929 *a*. A case of blastomycosis. *Bull. Soc. Path. exot.* **22**: 142–47; *Trop. Dis. Bull.*, **27**: 518.

—— AND ——. 1929 *b*. Preliminary note on a case of dermatomycosis with multiple verrucose or ulcerated patches. Antiseptic. *Bull. Soc. Path. exot.*, **22**: 417–32; *Trop. Dis. Bull.*, **27**: 578.

DEY, D. 1928. Further investigations on streptotrichosis or actinomycosis Bovi in India. *Indian vet. J.*, **5**: 277–78.

DEY, N. C. 1941. Notes on common skin diseases. III. Ringworm of the scalp (*Favus*). *Indian med. Gaz.*, **76**: 416.

—— AND GHOSH, L. M. 1944. Studies on ringworm. Part I. *Microsporon audomini* infection in India. *Ibid.*, **79**: 51.

—— AND ——. 1945. Studies on ringworm. Part II. Therapy of *Tinea capitis* by gonadotropic hormones. *Ibid.*, **80**: 381.

——, —— AND PANJA, D. 1940. Studies on ringworm. Part. V. Fungus diseases of the nails. *Ibid.*, **83**: 215.

—— AND MAPLESTONE, P. A. 1935. Ringworm of scalp in India. *Ibid.*, **70**: 541–44.

—— AND ——. 1941. *Trichophyton crateriforme* in India (*Tinea tonsurans*)—Black dot ringworm. *Ibid.*, **76**: 410.

—— AND ——. 1942. *Tinea imbricata* in India. *Ibid.*, **77**: 56.

DUTTA, S. 1931 *a*. Bursatee, an actinomycotic infection in horses in India. *Indian vet. J.*, **8**: 9–10.

———. 1931 *b*. A new fungus, *Edidamella actoni* parasitic to the dog. *Ibid.*, **8**: 169–78.

———. 1932. Actinomycosis in a buffalo heifer. *Ibid.*, **9**: 196.

DYMOCK, D. F. 1881. Fungus disease—Recurrence after amputation. *Indian med. Gaz.*, **16**: 56.

FITZERALD, G. H. 1932. A mycetoma-like condition of the foot. *Ibid.*, **67**: 517–18.

GHOSE, L. M. 1932. An unusual case of sporotrichosis. *Ibid.*, **67**: 570.

GHOSH, L. M. 1940. Notes on common skin diseases. I. Ringworm of the foot. *Ibid.*, **75**: 95.

———. 1941. Notes on common skin diseases. II. Ringworm of the scalp. *Ibid.*, **76**: 268.

———. 1948. An analysis of 50,000 cases as seen in the out-patient department of the tropical medicine, Calcutta, during the 5 years from 1942–46. *Ibid.*, **83**: 493–500.

——, DEY, N. C. AND PANJA, D. 1948. Studies of ringworm. Part IV. *Ibid.*, **83**: 493–500.

GHOSH, L. M. AND DEY, N. C. 1948. Studies of ringworm. Part VI. Ringworm of the glaborous skin. *Indian med. Gaz.*, **83**: 252.

—— AND ——. 1950. Madura foot (*Mycetoma*). *Ibid.*, **85**: 288.

—— AND MAPLESTONE, P. A. 1940. Epidermophytosis in a very young child. *Ibid.*, **75**: 95.

—— AND ——. 1941. An improved method of growing pure cultures of ringworm fungi. *Indian J. med. Res.*, **29**: 691–92.

—— AND PANJA, D. 1945. A case of rhinoscleroma. *Indian med. Gaz.*, **80**: 195.

—— AND ——. 1947. Studies of ringworm. Part III. Prophylactic measures. *Ibid.*, **82**: 200.

—— AND SEN, B. K. 1947. A case of dermatomyositis. *Ibid.*, **82**: 208.

GOYAL, R. K. 1938. A serological study of the Actinomyces. *Indian J. med. Res.*, **25**: 843–46.

GOVINDAN NAIR, V. 1942. Ringworm in Vizagapatam. *J. Indian med. Ass.*, **11**: 368.

IYER, P. R. K. 1936. An unusual case of epizootic lymphangitis in a mule. *Indian J. vet. Sci.*, **6**: 251–60.

JAYA RAM, SIRSI, AHMAD AND DAYALU. 1951–52. Blastomycosis of lung. *J. Indian med. Ass.*, **21**: 365.

KALAPESI, R. M. AND PUROHIT, B. L. 1954. A case of aspergillosis in a peacock. *Proc. 41st Indian Sci. Congr.*, pt. III: 219.

KALLIANPURKAR, S. L. 1948. Eczema of the foot. *Indian J. med. Sci.*, **2**: 101.

KARUP, P. K. 1931. *Rhinosporidium kinealyi*. *Indian med. Gaz.*, **66**: 239–41.

LALL, H. K. AND RAJAGOPALAN, V. R. 1949. Actinomycotic dermatitis in cross Merino Lamb. *Indian J. vet. Sci.*, **19**: 1–4.

MACKIE, F. P. 1921–22. Visceral infection due to higher fungi. *Indian J. med. Res.*, **9**: 781.

MAITLAND, J. 1898. Case of mycetoma of the abdominal wall. *Indian med. Gaz.*, **33**: 97.

MANGRULKAR, M. Y. 1938. Actinomycosis and actinobacillosis in animals in India. *Indian J. vet. Sci.*, **8**: 271–91.

MAPLESTONE, P. A. AND DEY, N. C. 1936. *Favus* (Infection of scalp) in India. *Indian J. med. Res.*, **23**: 687–99.

—— AND ——. 1938. Laboratory tests on the fungistatic and fungicidal effects of various substances. *Ibid.*, **25**: 603.

—— AND ——. 1939 *a*. A *microsporon* new to India. *Indian med. Gaz.*, **74**: 148–51.

—— AND ——. 1939 *b*. The use of dyes in various fungal infections. *Ibid.*, **74**: 391.

—— AND ——. 1941. Further laboratory tests on the fungistatic and fungicidal effects of various substances. *Indian J. med Res.*, **29**: 23.

—— AND MUKHERJEE, A. K. 1943. The treatment of Tæniases. *Indian med. Gaz.*, **78**: 282.

MARCONE, D. G. 1908. Saccharomycosis of the nasal fossæ of the horse simulating glanders. *J. trop. vet. Sci.*, **3**: 80–84.

MITRA, A. K. 1940. Otomycosis in a woman caused by *Aspergillus niger* Tieghem. *Curr. Sci.*, **9**: 371.

MUDALIAR, S. V. 1938. A preliminary note on a species of *Aspergillus* from a case of skin disease in a dog. *Indian J. vet. Sci.*, **8**: 395–97.

NASFIELD, V. B. 1907. Preliminary note on parasite found in connection with "The Irritable Summer Skin Disease" of horses in India. *J. trop. vet. Sci.*, **2**: 172–76.

NOBINDRO, U. 1934. Grass poisoning (actually fungus infection) among cattle and goats in Assam. *Indian vet. J.*, **10**: 235–36.

PALMER, F. J. 1926. A case of Madura foot treated by chemotherapy with apparent cure. *Indian med. Gaz.*, **61**: 74.

————. 1928. A second case of Madura foot treated by chemotherapy with apparent cure. *Ibid.*, **63**: 530–31.

PANJA, G. 1948. An unusual case of actinomycosis of cheek. *Ibid.*, **83**: 416.

—— AND BANERJEE, A. K. 1950. Perionychia due to *Monilia* infection. *Ibid.*, **83**: 215.

—— AND DEY, N. C. 1946. Sporotrichosis of the skin in India. *Ibid.*, **81**: 73.

POWELL, A. 1900. Ringworm in Assam. *Ibid.*, **35**: 109.

PRASAD, K. 1906. Notes on a case of fungus disease in India—"*Mycetoma* or Madura foot". *Ibid.*, **83**: 493–500.

RAJAGOPALAN, T. S. 1941. *Aspergillus* sp. as the cause of skin disease in animals' *Indian vet. J.*, **17**: 297–99.

RAMACHANDRA RAO, M. G. 1929. A case of *Mycetoma* of the hand and foot. *Indian med. Gaz.*, **73**: 329–30.

RANANAVRE, M. N. 1951. Actinomyces of the lung. *Indian J. med. Sci.*, **5**: 63–65.

RAO, M. A. N. 1938. Rhinosporidiosis in bovine in the Madras Presidency with a discussion on the probable modes of infection. *Indian J. vet. Sci.*, **8**: 187–98.

SAHA, B. 1918. A case of actinomycotic pleuromediastinitis. *Indian med. Gaz.*, **53**: 11.

SAHAI, L. 1938. Rhinosporidiosis in equines. *Indian J. vet. Sci.*, **8**: 221–23.

SEMON, M. C. 1915. Case of Madura foot. *Brit. J. Derm.*, **27**: 240–41.

SEN, S. N. 1951. Pulmonary actinomycosis. *Indian med. Gaz.*, **86**: 100.

SMITH, J. 1898. Notes on a case of mycetoma of the neck. *Ibid.*, **35**: 96.

SUR, T. 1918. Observations on 3 cases of actinomycosis hominis. *Ibid.*, **53**: 5.

TRIVEDI, B. P. AND MUKHERJEE, B. N. 1939. Actinomycosis and mycotic lesions with special reference to Madura foot. *Brit. J. Surg.*, **27**: 256–65.

—— AND SARKAR, S. R. 1952. Pulmonary actinomycosis. *Indian J. med. Sci.*, **6**: 595–96.

VASUDEVAN, A. 1932. An unusual type of parasitic infection of forearm. *Indian J. med. Res.*, **20**: 299–302.

—— AND SESHADRINATHAN, N. 1929. A few observations of mycetoma: A preliminary communication. *Ibid.*, **17**: 170–73.

WADE BROWN. 1898. Dhobi's itch—Correspondence to the editor. *Indian med. Gaz.*, **33**: 357.

337–58 Printed at the Bangalore Press, Bangalore City,
by C. Vasudeva Rao, Superintendent.